Final

ENVIRONMENTAL ASSESSMENT FOR ROUTINE AND RECURRING UNMANNED AERIAL VEHICLE FLIGHT OPERATIONS AT EDWARDS AIR FORCE BASE, CALIFORNIA

November 2006

95th Air Base Wing
Civil Engineer Directorate
Environmental Management Division
Edwards Air Force Base, California

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE **03 DEC 2006**	2. REPORT TYPE	3. DATES COVERED
4. TITLE AND SUBTITLE **Environmental Assessment for Routine and Recurring Unmanned Aerial Vehicle Flight Operations at Edwards Air Force Base, California**		5a. CONTRACT NUMBER **DACA05-01-D-0005**
		5b. GRANT NUMBER
		5c. PROGRAM ELEMENT NUMBER **N/A**
6. AUTHOR(S)		5d. PROJECT NUMBER
		5e. TASK NUMBER
		5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **95th Air Base Wing, Civil Engineer Directorate, ,Environmental Management Division,5 E. Popson Ave, Bldg 2650A,Edwards Air Force Base,CA,93524**		8. PERFORMING ORGANIZATION REPORT NUMBER **N/A**
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		10. SPONSOR/MONITOR’S ACRONYM(S)
		11. SPONSOR/MONITOR’S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT
This Environmental Assessment evaluates the potential environmental impacts associated with the flight operations for test and evaluation of Unmanned Aerial Vehicles by the Air Force Flight Test Center within the R-2508 Complex of special use airspace and Edwards Air Force Base, California, with flights to the Naval Air Weapons Center Point Mugu Sea Range, and Nellis Test and Training Range via transitional corridors.

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**1**	**304**	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18

This page intentionally left blank.

FINDING OF NO SIGNIFICANT IMPACT FOR ROUTINE AND RECURRING UNMANNED AERIAL VEHICLE FLIGHT OPERATIONS AT EDWARDS AIR FORCE BASE

1.0 INTRODUCTION

The U.S. Air Force proposes to continue the routine and recurring mission of the Air Force Flight Test Center (AFFTC) as the center of flight and flight systems test and evaluation for the Air Force by evolving the capability to test unmanned aerial vehicles (UAVs) and their associated aeronautical systems in the same manner as manned aircraft. This document serves as a programmatic assessment of the environmental effects of and any mitigation that may be required for testing and evaluating a variety of UAVs at Edwards Air Force Base (AFB) (within the R-2508 Complex) and flights between the R-2508 Complex and both the Naval Air Weapons Center Point Mugu Sea Range and Nellis Test and Training Range. To fulfill the goals of the Office of the Secretary of Defense, the AFFTC needs to conduct test and evaluation of developmental UAVs to demonstrate critical technologies in a realistic, yet controlled environment in support the Air Force goal of meeting future requirements that are considered necessary for the defense of the territorial United States.

2.0 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES CONSIDERED

The Proposed Action would conduct up to 152 flight tests (including chase aircraft) in 2006—increasing to up to 528 flight tests (including chase aircraft) in 2011—for all classes of UAVs within the R-2508 Complex. Alternative B would limit the tests to Edwards AFB and the R-2515 special use airspace, Alternative C would limit the tests to the airspace above Edwards AFB, and Alternative D, the No-Action Alternative, would allow for the continued operation of current programs like the Global Hawk and Predator UAVs.

3.0 ENVIRONMENTAL CONSEQUENCES

The Region of Influence (ROI) of the proposed project consists primarily of Edwards AFB, restricted area R-2515, and the R-2508 Complex. The ROI for each alternative is discussed in terms of those three regions. Resources within the ROI have been identified and evaluated under the following categories: air quality, airspace management and air safety, hazardous waste/hazardous materials, natural resources, noise, and safety. No potentially significant impacts were identified to any of these areas under the alternatives considered based on the potential significance and ongoing implementation of best management practices. This finding was based primarily on the fact that:

- The number of flights would result in an increase in air emissions; however, these emissions would only be between 5 to 30 percent of the *de minimis* levels.

- The number of flights if added to the total number of flights conducted in 2005 would be less than the 5-year average. The increase would be less than 1.5 percent over the number of flights occurring in the R-2508 Complex.

- Increases in use of hazardous materials and generation of hazardous waste would be less than 0.2 percent for a base that routinely disposes of over 600,000 pounds of hazardous waste.

- UAV flight operations would use existing facilities and disturbed areas, thus minimizing the potential for any impacts on natural resources.

- Noise levels at Edwards AFB would increase by less than 0.1 A-weighted decibel for subsonic noise and less than 1.5 C-weighted decibels for impulsive noise (supersonic noise); however, the day-night average noise level and C-weighted day-night level would still be below the threshold for acceptability as identified by U.S. Environmental Protection Agency.

Decisions regarding the significance of impacts, as defined under the National Environmental Policy Act of 1969 (NEPA), are based on a consensus of the interpretation of environmental laws, rules, and regulations by cognizant federal, state, and local agencies; previously certified environmental documentation for similar projects; and trained and experienced professionals in each environmental field.

Cumulative Impacts

Alternatives A, B, C, or D would have no significant cumulative impacts to air quality, airspace, hazardous waste, natural resources, noise, or to any other issue area analyzed in this Environmental Assessment (EA). Over 90 to 95 percent of the past, present, and reasonably foreseeable actions occurring in the ROI are associated with ongoing operations at Edwards AFB. Other major actions and projects considered would represent only a very small percentage of the total number of actions. No significant cumulative impacts would occur because no new facilities would be constructed, no ground disturbing activities would occur other than at preexisting disturbed areas; and existing facilities and disturbed areas would be used to the maximum extent possible.

Short-term Versus Long-term Productivity of the Environment

No new construction or other development would be required under the Routine and Recurring UAV Flight Operations Program, and current Air Force or contractor personnel from other bases would be used for the program. Neither Alternative A, B, C, nor D would involve any short- or long-term changes in population or productivity of the environment.

Irreversible and Irretrievable Commitments of Resources

This EA addresses the routine and recurring flight operations for UAVs operating within the R-2508 Complex. Conducting these flight tests would not require an irreversible or irretrievable commitment of resources. UAV flight operations could be terminated without affecting other programs because it is normal for programs to be initiated and completed once a flight test program has matured and moved from the test and evaluation to the operational phase of the life cycle. Irreversible or irretrievable commitment of resources that would be involved in other phases of the program (e.g., UAV fabrication and transportation to the site) would be addressed in separate environmental documentation when ripe for consideration. Implementation of Alternative D (No-Action Alternative) would also not require an irreversible or irretrievable commitment of resources.

4.0 CONCLUSION

On the basis of the findings of the EA, no significant impact to the human environment would be expected from implementation of the Proposed Action or Alternatives. No mitigation measures are recommended. Therefore, issuance of a Finding of No Significant Impact (FONSI) is warranted, and preparation of an Environmental Impact Statement, pursuant to NEPA (Public Law 91-190) is not required. Background information that supports the research and development of this FONSI and the EA is on file at Edwards AFB and may be obtained by contacting: Mr. Gary Hatch, Environmental Public Affairs, 95ABW/PAE, 5 E. Popson Avenue, Building 2650A, Edwards AFB, California 93524-8060.

95ABW/PAE
Environmental Management ATTN: Mr. Gary Hatch
5 E. Popson Avenue, Building 2650A
Edwards AFB, California 93524-8060
(661) 277-1454

James E. Judkins

JAMES E. JUDKINS, NH-IV
Base Civil Engineer

3 Dec 06
Date

This page intentionally left blank.

EXECUTIVE SUMMARY

1.0 INTRODUCTION

This Environmental Assessment (EA) evaluates the potential environmental impacts associated with the flight operations for test and evaluation of unmanned aerial vehicles (UAVs) by the Air Force Flight Test Center (AFFTC) within the R-2508 Complex of special use airspace and Edwards Air Force Base, California, with flights to the Naval Air Weapons Center Point Mugu Sea Range (Sea Range), and Nellis Test and Training Range (NTTR) via transitional corridors.

This EA is being prepared in accordance with the requirements of the National Environmental Policy Act (NEPA) of 1969, as amended (42 United States Code 4321 *et seq*.); the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal regulations [CFR] 1500–1508); U.S. Air Force Instruction 32-7061, *The Environmental Impact Analysis Process (EIAP)*; Title 32 CFR Part 989, which implements these regulations in the EIAP; and all other applicable federal and local regulations. The AFFTC is representing the Department of Defense as the lead agency.

2.0 PURPOSE AND NEED

The purpose of the Proposed Action is to continue the routine and recurring mission of the AFFTC as the center of flight and flight systems test and evaluation for the Air Force by evolving the capability to test UAVs and their associated aeronautical systems in the same manner as manned aircraft.

Most UAV test and evaluation activities would occur within the R-2508 Complex airspace; however, some flight test operations would also occur outside the R-2508 Complex. Due to the continuously changing nature of flight test programs as they go through a normal cycle of build-up, full operation, and completion, the percentage of flights outside the R-2508 Complex would vary from year to year, accounting for as few as 5 percent to as many as 40 percent of the total UAV flights. To best account for impacts, the analysis was done assuming a maximum of 40 percent of the flight operations would occur outside of the R-2508 Complex, requiring flight between the R-2508 Complex and the Sea Range and NTTR airspace, transitioning through the Federal Aviation Administration (FAA) controlled National Airspace System (NAS) under a pre-approved Certificate of Authorization (COA). Table 1 lists the projected/estimated maximum UAV test and evaluation and chase aircraft flights that would occur under

this program. For analysis, each flight would include one takeoff and one landing by the UAV; however, some UAVs may be air-dropped, hand-launched, or launched from locations other than the runway.

Table 1
Projected/Estimated UAV Test and Evaluation and Chase Aircraft Flights Originating at Edwards AFB

	Number of Flights				
Year	Small UAVs	Medium UAVs	Large UAVs	Chase Aircraft	Annual Total
2006	20	30	30	72	152
2007	30	90	45	140	205
2008	50	115	50	172	387
2009	75	125	60	195	455
2010	90	125	70	200	485
2011	100	150	80	198	528
2012	100	150	80	165	495

3.0 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

The UAV test and evaluation flights as shown in Table 1 and conducted under Alternative A would operate throughout R-2508 Complex airspace. In general, most UAV test and evaluation flights would take off from Edwards AFB and return to Edwards AFB as the final destination. However, up to 40 percent of the flights would transition to the Sea Range or NTTR via the FAA controlled NAS under a pre-approved COA. This region of influence (ROI) for Alternative A would include the R-2515 restricted area and airspace above Edwards AFB.

The UAV test and evaluation flights shown in Table 1 and conducted under Alternative B would operate primarily in restricted area R-2515. Similar to Alternative A, up to 40 percent of the UAV flights would transition to the Sea Range and NTTR via the FAA controlled NAS under a pre-approved COA. This ROI would include restricted area R-2515 and the airspace above Edwards AFB.

The proposed UAV test and evaluation flights shown in Table 1 and conducted under Alternative C would primarily occur in the airspace above Edwards AFB. However, similar to Alternatives A and B, UAV flights would also transition to the Sea Range and NTTR via the FAA controlled NAS under a pre-approved COA. Under Alternative C, all UAV test and evaluation flights would take off from Edwards AFB and return to Edwards AFB as the final destination.

Alternative D (No-Action Alternative) is the status quo. UAV test and evaluation flights would continue to be conducted at the rate and manner currently planned under program specific analyses. This would include (among others) such programs as Global Hawk, Predator, Unmanned Combat Air Vehicle (UCAV), and other UAV operations similar to manned aircraft flight test operations. These programs would continue to use existing facilities and buildings that would be modified on an as-needed basis.

4.0 SUMMARY OF ENVIRONMENTAL IMPACTS AND SIGNIFICANCE/MITIGATION MEASURES

The analysis indicates that none of the impacts individually or collectively would be significant. Measures to protect the various resource areas have been incorporated into the description of each action alternative. The potential effects and significance/mitigation measures are summarized below.

4.1 AIR QUALITY

The primary impacts to air quality from the Proposed Action would come from emissions from the various vehicles and support equipment. UAV operations would make a relatively small contribution to the overall air emissions at Edwards AFB. In all cases, the emission levels would be well below the *de minimis* levels established by regulation, ranging from only 5 to 30 percent of the threshold levels.

4.1.1 Significance/Mitigation Measures

There were no significant impacts identified because the projected emissions for the limited number of flights for all of the Alternatives considered would be well below *de minimis* levels, have no new or unique emissions or local issues, and no other measurable impacts were identified. No mitigation measures are proposed because air emissions are accounted for in current air permits, no construction is planned, and ground disturbing activities would be limited to pre-existing disturbed areas.

4.2 AIRSPACE MANAGEMENT AND AIR SAFETY

The primary impact on airspace management and air safety for the Proposed Action and Alternatives would result from additional flight operations in the R-2508 Complex and the FAA controlled NAS; however, the number of UAV and chase aircraft flight operations would only increase the current number of flight operations by an extremely small percentage. Potential air safety impacts, as with the operation of any aircraft, would be related to the ability of the UAVs and chase aircraft to see and avoid other aircraft as well as the pilots' and trained operators' ability to deal with contingencies without creating

additional risks to people or property. Pilots, trained operators, and chase aircraft, or a combination of these, would provide a margin of safety so UAVs can see and avoid other aircraft and thus reduce the risk to people and property to acceptable standards. The criterion for UAV reliability and adequacy of safeguards (this criterion is summarized in Appendix B of this EA) is integral to the safety analysis completed by the Range Safety Office for each UAV flight test.

The projected number of flight operations—when compared to the level of flight activity in the R-2508 Complex—represents a less than 0.5 percent increase in flight operations in 2006 to 1.5 percent increase in 2011 (approximately 1.41 percent increase in 2012). The percentage of UAV and chase aircraft flight operations operating at Edwards AFB and in restricted area R-2515 would be higher than for the R-2508 Complex; however, the increase would still be less than 6 percent if added to the current level of operations. Because these new UAV programs would likely replace current programs, the actual increase would be expected to be even smaller.

4.2.1 Significance/Mitigation Measures

Flight operations for UAVs operating in the R-2508 Complex, restricted area R-2515, and Edwards AFB and transitioning to the Sea Range or NTTR would be accomplished in accordance with strict guidelines promulgated by both the Air Force and FAA. By following these guidelines, which include training requirements for pilots and operators and safety analyses, the impacts on airspace management and air safety created by UAV and chase aircraft flight operations would be less than significant. The Air Force and National Aeronautics and Space Administration (NASA) would continue to conduct operations in accordance with best management practices.

4.3 HAZARDOUS MATERIALS/HAZARDOUS WASTE/SOLID WASTE

The weight of the hazardous waste generated by the UAVs when compared to the quantity of hazardous waste generated annually at Edwards AFB would be extremely small. The predicted weights are shown in Table 4-3 of the EA and would result in a less than 0.2 percent increase during any year; therefore the impacts on hazardous materials, hazardous waste, and solid waste resulting from UAV flight operations would be less than significant. Impacts on hazardous waste/hazardous materials and solid waste resulting from UAV flight operations would come from the maintenance, servicing, and operation of the UAVs, aircraft, and support equipment.

4.3.1 Significance/Mitigation Measures

The types of wastes generated during UAV flight operations support would be similar to current waste streams for manned aircraft. Edwards AFB generates over 600,000 pounds of hazardous waste annually and is classified as a large quantity hazardous waste generator. An increase of 0.2 percent would not change the hazardous waste generator status of the base. The small quantities of waste could easily be assimilated and managed by current management practices. Since the types of wastes would not be new, would not change the generator status, would be the same as those already being generated by other programs, and could be managed by current practices, it could reasonably be concluded that a 0.2 percent increase in waste created from UAV flight operations would be less than significant. Edwards AFB would continue to implement standardized hazardous waste/hazardous material/solid waste management procedures and best management practices associated with use and disposal of hazardous materials/hazardous waste and solid waste.

4.4 NATURAL RESOURCES

Potential impacts on natural resources would be attributed to effects from contact with UAVs, chase aircraft, program personnel, support equipment, or the testing of associated weapon systems. UAV flight related activities would use existing runways, previously disturbed areas, roadways, and targets already approved for similar types of operations. The potential impacts were compared to the ten ecological processes identified by the U.S. EPA and were found to be less than significant because of the relatively small number of flights, UAVs would use existing runways or previously disturbed areas for launch and landing, no construction is planned, and ground disturbing activities would be limited to pre-existing disturbed areas.

4.4.1 Significance/Mitigation Measures

Unmanned aerial vehicle flight operations would have minimal contact with natural resources including plants, wildlife, and habitat because operations would primarily be conducted from previously disturbed areas that do not typically support these resources. Consequently, it could reasonably be concluded that impacts would be less than significant under Alternative A, B, C, or D. UAV flight operations would abide by management practices that have been implemented by the AFFTC and Edwards AFB to minimize disturbances to natural resources. There would be a relatively small number of flights, UAVs would use existing runways or previously disturbed areas for launch and landing, no construction is planned, and ground disturbing activities would be limited to pre-existing disturbed areas.

4.5 NOISE

The primary impacts on noise from the Proposed Action and Alternatives would be from the UAVs, chase aircraft, and support equipment. The noise contribution from subsonic UAV flight operations at Edwards AFB resulting from a 6 percent increase in flight operations would increase the accepted day-night average noise level (DNL or L_{dn}) by less than 0.1 decibel over current levels. Noise contributions by UAVs and chase aircraft traveling faster than the speed of sound would also add to the C-weighted impulse noise. The threshold level of acceptability for impulse noise impacts is based on the C-weighted day-night level (CDNL orL_{cdn}) of 61 C-weighted decibels (dBC). Predicted CDNLs at Edwards AFB and within the R-2515 are below L_{cdn} 57.5 dBC (AFFTC 1998). Currently, no UAVs fly at supersonic speeds. If in the future supersonic UAVs are developed, they would be expected to account for a very small percentage of the total number of proposed flight operations. If 20 percent of the UAV and chase aircraft flights exceeded the speed of sound, then an increase of less than 2 percent of supersonic flight activity would be predicted.

4.5.1.1 Significance/Mitigation Measures for Noise Impact in the R-2508 Complex

The Air Force will maintain a minimum altitude of 3,000 feet above ground level vertically and 3,000 feet laterally in proximity to the noise sensitive areas in the R-2508 Complex as described in the *R-2508 Environmental Baseline Study*. This would include flight operations in the Isabella, Owens, Panamint, and Saline work areas that overlie several land management areas including:

- Sequoia-Kings Canyon National Park;
- John Muir Wilderness;
- Domeland Wilderness (1977 boundaries); and
- Death Valley National Park (boundaries as designated for Death Valley National Monument in 1994).

Low level operations over the Sequoia National Forest are also limited from May 23 to September 30 after 8:00 p.m. on all Fridays, Saturdays, and extending into Sunday nights, and during the Memorial Day, Independence Day, and Labor Day weekends except mission essential flights that have been coordinated with the Central Coordinating Facility at least 3 working days prior to the low-level flight.

4.6 OCCUPATIONAL HEALTH AND SAFETY

The primary impacts on safety and occupational health for the Proposed Action and Alternatives come from weapons, flight, ground, range, and test [systems] safety hazards as well as radiological, biological, chemical, and physical hazards normally associated with aircraft flight operations at Edwards AFB. Extensive training of personnel, specific operating procedures, established safety and hazard zones that restrict access to dangerous areas or operations, and continuous monitoring by base and range safety personnel would ensure that UAV flight operations were conducted in a manner that reduced the opportunity for an impact on safety and occupational health. Therefore, UAV flight operations would not be expected to create any significant impacts on safety and occupational health.

4.6.1 Significance/Mitigation Measures

Since there would be no significant effects or impacts on safety or occupational health resulting from UAV flight operations, no mitigation measures would be required.

4.7 CUMULATIVE IMPACTS

Over 90 to 95 percent of the past, present, and reasonably foreseeable actions occurring in the ROI are associated with ongoing operations at Edwards AFB. Other major actions and projects considered would represent only a very small percentage of the total number of actions, and none of the actions would result in significant cumulative impacts.

5.0 APPENDICES

Air emission calculations, reference documents for resource areas, example photos of UAVs, the distribution list, and response to comments (included with the Final EA) are provided in Appendices A through G of this EA.

This page intentionally left blank.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

APPENDICES

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES (Continued)

This page intentionally left blank.

1.0 PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

This Environmental Assessment (EA) evaluates the potential environmental impacts associated with the flight operations for test and evaluation of unmanned aerial vehicles (UAVs) by the Air Force Flight Test Center (AFFTC) within the R-2508 Complex of special use airspace and Edwards Air Force Base (AFB), California, with flights to the Naval Air Weapons Center (NAWC) Point Mugu Sea Range (Sea Range), and Nellis Test and Training Range (NTTR) via transitional corridors. Numerous other EAs and other National Environmental Policy Act (NEPA) documents have been written to describe the potential impacts of flight operations on these ranges. A list of the most current documents that address concerns to those of the Proposed Action can be found in Section 3.0.

This EA is being prepared in accordance with the requirements of the NEPA of 1969, as amended (42 United States Code [U.S.C.] 4321 *et seq.*); the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations [CFR] 1500–1508); U.S. Air Force Instruction (AFI) 32-7061, *The Environmental Impact Analysis Process (EIAP)*; Title 32 CFR Part 989, which implements these regulations in the EIAP; and all other applicable federal and local regulations. The AFFTC is representing the Department of Defense (DoD) as the lead agency.

1.2 LOCATION OF PROPOSED ACTION

The Proposed Action would occur primarily on Edwards AFB and within the R-2508 Complex. Edwards AFB is located in the Antelope Valley region of the western Mojave Desert in Southern California, about 60 miles northeast of Los Angeles, California. Portions of the Base lie within Kern, Los Angeles, and San Bernardino counties. The Base occupies an area of approximately 301,000 acres or 470 square miles. The Base is located entirely within R-2515 restricted airspace in the southern portion of the R-2508 Complex. The whole R-2508 Complex of special use airspace (SUA) occupies an area of approximately 19,600 square miles, extending from 45 miles north of Los Angeles, California, to 10 miles south of Bishop, California. The boundary of the R-2508 Complex approaches the Nevada border on the east and Bakersfield and Fresno, California, on the west (Figure 1-1). The Sea Range is located approximately 75 nautical miles southwest of Edwards AFB over the Pacific Ocean, and the NTTR is located approximately 140 nautical miles northeast of Edwards AFB (Figure 1-2).

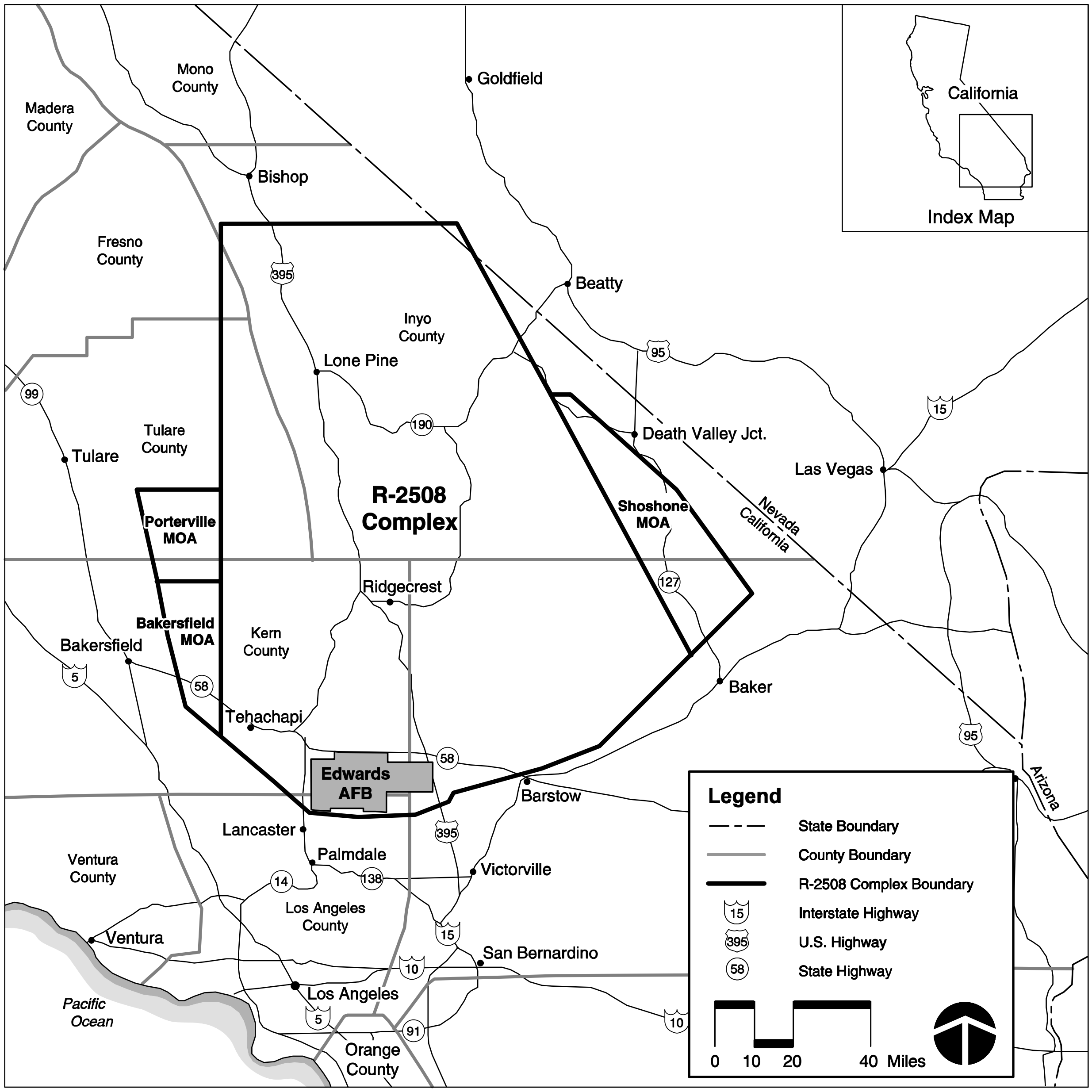


Figure 1-1 General Vicinity Map

1.3 PURPOSE OF THE PROPOSED ACTION

The purpose of the Proposed Action is to continue the routine and recurring mission of the AFFTC as the center of flight and flight systems test and evaluation for the Air Force by evolving the capability to test UAVs and their associated aeronautical systems in the same manner as manned aircraft.

Figure 1-2 Region of Interest for Proposed Action and Alternatives

Because of the evolution of military flight operations into UAV operations, the AFFTC must be able to conduct the same level of flight test activity for UAVs as it has for manned aircraft for many years. The mission of the AFFTC has developed from a high performance aircraft flight test facility in the 1950s and 1960s to that of a high technology test and evaluation center for complete aircraft/avionics systems. Thus, UAV testing is a continuation of the evolving primary mission of the AFFTC and is fully in accord with that mission as it has advanced since the 1940s. The UAV is a tightly integrated system of airframe, engine, avionics (sensors and communications systems), and weapons (when present). Current weapons

are so integral to the avionics and sensor suite of the aircraft that it is impossible to test any part of the system (aircraft, avionics, or weapon) individually.

The Proposed Action is to conduct test and evaluation of UAVs by the AFFTC in the same manner that test and evaluation of manned aircraft has been conducted for many years. This document serves as a programmatic assessment of the environmental effects from and any mitigation that may be required for testing and evaluating a variety of UAVs at Edwards AFB (within the R-2508 Complex) and flights between the R-2508 Complex and both the Sea Range and NTTR.

1.4 NEED FOR THE PROPOSED ACTION

To fulfill the goals of the Office of the Secretary of Defense, the AFFTC needs to conduct test and evaluation of developmental UAVs to demonstrate critical technologies in a realistic, yet controlled environment. Modeling and simulation only validates a portion of the requirements necessary to deploy new UAV systems.

2.0 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2.1 INTRODUCTION

This section describes the Proposed Action and Alternatives, including the No-Action Alternative. The potential environmental impacts of each alternative are summarized in table form at the end of this chapter.

2.2 ALTERNATIVE IDENTIFICATION PROCESS

The analysis of the Proposed Action and Alternatives is the cornerstone of the EA. It is intended to provide the decision maker and the public a clear understanding of the relevant issues and the basis of the choice among identified options. The alternatives must fulfill the need and purpose of the Proposed Action and be consistent with the goals, policies, management strategy, and mission requirements of the AFFTC.

The criteria identified here establish a minimum set of requirements that must be met in order for an alternative to be considered viable. Those alternatives not meeting one or more of the selection criteria have been eliminated from further discussion. Alternatives meeting all selection criteria have been retained and each is fully analyzed in Chapter 4 (Environmental Consequences) of this EA.

The criteria used to select the alternatives discussed in this document are described below. They address the need to test the fully integrated UAV in a controlled field environment. A viable alternative would:

- Present a broad range of airspace test areas for operations of the UAV aircraft and its applicable subsystems,
- Allow full functioning of the UAV aircraft for complete system evaluation with specialized subsystems;
- Provide for the testing of UAV aircraft that would meet the Secretary of Defense Office and National Aeronautics and Space Administration (NASA) operational requirements;
- Provide a full range of instrumentation and data reduction capability;
- Include a wide range of targets and target areas for evaluation of UAV weapons delivery system effectiveness;

- Support operation of all UAV aircraft subsystems integration (e.g., electrical, hydraulic, avionics, engines, flight controls);
- Permit operations of both the UAV aircraft and subsystems without restrictions that would invalidate test results;
- Allow continued normal manned aircraft operations in parallel with UAV operations; and
- Provide an environment that meets federal, state, NASA, and Air Force safety requirements.

Radio controlled airplanes flown for recreational purposes will not be considered in this assessment.

2.2.1 UAV Categories Potentially Tested at Edwards AFB

Within the DoD UAV Master Plan, UAVs are considered in terms of operational utility. During operations where more than one system is available, UAV systems are task-organized and categories selected to achieve the required flexibility and capability. The current listing of UAV categories as recognized by the DoD UAV Master Plan include:

- Hand-Launched UAV (HL-UAV). Small, expendable hand-launched UAVs for tactical use with short flight durations;
- Maneuver-UAV (M-UAV). Flight duration of up to 3 hours with a range of approximately 50 kilometers (km).
- Joint Tactical-UAV (JT-UAV). Flight duration of approximately 8 to 10 hours designed to penetrate into enemy airspace out to a range of 200 km with data link.
- UAV-Endurance (UAV-E). Flight duration of 36 hours or greater and capable of performing multiple missions simultaneously in an all-weather environment out to a range in excess of 800 km.

The UAV categories are continually evolving. Additional categories identified in the *Unmanned Aircraft Systems Roadmap 2005 - 2030* (Office of the Secretary of Defense 2005) include Major UAS (unmanned aircraft systems), Concept Exploration UAS, Special Operations UAS, Small UAS, and Unmanned Airships. All of these categories could be tested at Edwards AFB and would be expected to have characteristics and impacts similar to the previous classes of UAVs.

The test and evaluation of UAVs would use essentially the same processes and procedures as test and evaluation of manned aircraft. The test plan for both is structured around the unique characteristics and

performance of the air vehicle and its associated aeronautical systems. Flight operations, data collection, analysis, and safety considerations are similar. The primary difference is in management of the command and control system of the UAV, which normally includes a robust backup or fail-safe capability.

2.2.2 UAV Classifications

The UAVs will be classified as small, medium, and large in this EA. They range in gross weight from less than 10,000 pounds for the small UAVs, to gross weights of approximately 10,000–20,000 pounds for medium fighter/attack sized UAVs, to gross weights over 20,000 pounds for the larger UAVs. Examples of these different classes of UAVs are provided in Appendix E.

2.3 DESCRIPTION OF THE ALTERNATIVES

The location for the Proposed Action and Alternatives is primarily within the R-2508 Complex (see Figure 1-2). References to the “R-2508 Complex” in this document include all the special use airspace within the outer boundary of the multiple SUAs shown in Figure 1-1. A detailed description of the airspace for the proposed operating areas is provided in Chapter 3, Section 3.2 and Appendix B, Airspace Management. Most UAV test and evaluation activities would occur within the R-2508 Complex airspace; however, some flight test operations would also occur outside the R-2508 Complex. Due to the continuously changing nature of flight test programs as they go through a normal cycle of build-up, full operation, and completion, the percentage of flights outside the R-2508 Complex would vary from year to year, accounting for as few as 5 percent to as many as 40 percent of the total UAV flights. To best account for impacts, the analysis was done assuming a maximum of 40 percent of the flight operations would occur outside of the R-2508 Complex, requiring flight between the R-2508 Complex and the Sea Range and NTTR airspace, transitioning through the Federal Aviation Administration (FAA) controlled National Airspace System (NAS) under a pre-approved Certificate of Authorization (COA).

Table 2-1 lists the projected/estimated maximum UAV test and evaluation and chase aircraft flights that would occur under this program. For analysis, each flight would include one takeoff and one landing by the UAV; however, some UAVs may be air-dropped, hand-launched, or launched from locations other than the runway. Approximately 90 percent of the UAV flights would require chase aircraft in 2006. As operations became more and more routine, the requirement for chase aircraft would be expected to decrease to approximately 50 percent in 2012 as shown in Table 2-1. Additional UAV flights launched from other locations in the general vicinity of Edwards AFB, but not from Edwards AFB, would operate

above 3,000 feet above ground level (AGL) in the R-2508 Complex except for approximately 5 percent of the flights. Table 2-2 shows the number of flights expected from these sources from 2006 through 2012.

Table 2-1

Projected/Estimated UAV Test and Evaluation and Chase Aircraft Flights Originating at Edwards AFB

	Number of Flights				
Year	**Small UAVs**	**Medium UAVs**	**Large UAVs**	**Chase Aircraft**	**Annual Total**
2006	20	30	30	72	152
2007	30	90	45	140	205
2008	50	115	50	172	387
2009	75	125	60	195	455
2010	90	125	70	200	485
2011	100	150	80	198	528
2012	100	150	80	165	495

Table 2-2

Projected/Estimated UAV and Chase Aircraft Flights Using R-2508 Airspace and Not Originating or Landing at Edwards AFB

	Number of Flights		
Year	**Medium UAVs**	**Chase Aircraft**	**Annual Total**
2006	240	240	480
2007	360	360	720
2008	600	600	1,200
2009	600	600	1,200
2010	600	600	1,200
2011	600	600	1,200
2012	600	600	1,200

2.3.1 Alternative A (UAV Flight Operations Within the R-2508 Complex) (Proposed Action)

The UAV test and evaluation flights shown in Table 2-1 and conducted under Alternative A would operate throughout R-2508 Complex airspace. In general, most UAV test and evaluation flights would take off from Edwards AFB and return to Edwards AFB as the final destination. However, up to 40 percent of the flights would transition to the Sea Range or NTTR via the FAA controlled NAS under a pre-approved COA. This region of influence (ROI) for Alternative A would include the R-2515 restricted

area and airspace above Edwards AFB. Ground activities and flight activities associated with the implementation of Alternative A are described below.

2.3.1.1 Ground Activities

Ground activities during testing of UAVs would be similar to those currently conducted during manned aircraft flight testing. The UAV ground activities would consist of ground system testing, maintenance, preparation, and flight tracking activities. Both scheduled and unscheduled maintenance activities would occur. Scheduled maintenance activities would include preflight and post-flight activities. Unscheduled maintenance would be performed as needed. Typical maintenance activities would include corrosion control, low-observable repair, UAV wash down, system/subsystem repair, and servicing. Servicing would include adding petroleum, oil, hydraulic fluids, fuels, coolants, and refrigerants to the systems; using solvents, sealants, epoxies, solder, and adhesives for repair activities; and charging and replacing batteries. UAVs would be fueled on the ramp or in the hangar; however the very small UAVs could also be fueled in the field. Preflight checks would be conducted prior to each takeoff (similar to manned aircraft preflight checks) and would include engine stabilization, pre-launch inspection, and taxiing the UAV to the active runway for those UAVs launched from the runway. Maintenance and flight preparation activities would occur in existing hangars, facilities, or on the ramp for most UAVs; however, the small, hand-launched UAVs could be prepared in the field. Control centers in mobile trailers similar to those used by the Joint Unmanned Combat Air Systems (J-UCAS) program (while operating at Edwards AFB) would be used for controlling the UAVs. The UAVs could also be controlled by operators at Edwards AFB and NAWC China Lake, or from mobile control stations, laptop computers with portable antennas and transmitters, other aircraft, or military command posts via satellite links from other locations.

Tracking of UAV test and evaluation flights would often use ground-based or active airborne global positioning system (GPS) tracking systems like ARDS, Gainer, and Plate, which are independent of the UAV system. The NASA C-Band tracking radars could also be used for tracking activities. Normally the Ridley Mission Control Center (RMCC) (Building 1440) operated by Edwards AFB personnel or the Dryden Range operated by NASA Dryden Flight Research Center (DFRC) personnel would be used for flight tracking activities.

2.3.1.2 Flight Activities

Performance and propulsion characteristics for each UAV would be collected and evaluated. The types of propulsion systems would be similar to those currently used on Air Force and DOD aircraft. These systems would include piston engines with propellers and turbo propellers (turboprops), electric engines with propellers and turboprops (powered by batteries, fuel cells, or solar cells), turbojet and turbofan engines, and rocket-based combined cycle ramjet/scramjet engines as well as solid propellant rockets for boost during the launch phase. The UAVs would operate at altitudes up to 120,000 feet above mean sea level (MSL) and at airspeeds from very low for the smaller, micro-sized UAVs to speeds faster than the speed of sound. The flight times for the different UAVs would range from less than an hour for the small UAVs to over 36 hours for the long endurance UAVs. Specialized systems to be integrated and tested on UAVs could include a range of electronics including video, infrared, acoustic, communication relay, directed energy systems (i.e., lasers and high power microwaves), electronic countermeasures, atmospheric sensors, and weapon systems. Any weapon system not similar to those already analyzed to the appropriate level of NEPA documentation will be analyzed. Additional flight activities that would be tested include any activity conducted by manned aircraft (e.g., inflight refueling and multiple UAVs operating at the same time).

Flight termination systems (FTSs) may be installed on many UAVs until the individual vehicles meet the FAA and Range Commander Council risk criteria. Some platforms could be outfitted with FTSs incorporating high explosives while other platforms could use methods that would not use explosive devices to destroy the vehicle; instead the FTS would shut off the engine and send the vehicle into a controlled spin if the command and control sequence was lost or if it departed from normal, controlled flight. Some UAVs would be equipped with parachutes to facilitate recovery in lieu of an FTS that incorporates explosive devices. For some of the smaller UAVs the cost of the FTS is not warranted due to the size and weight of the vehicle. For these smaller UAVs, acceptable loss of command and control, mitigation, and risk acceptance would be determined by the safety planning and review process as defined by Air Force Flight Test Center Instruction (AFFTCI) 91-5.

2.3.1.3 Personnel Requirements

Historically, the number of personnel supporting flight test programs at Edwards AFB and NASA DFRC remains constant. Government personnel would be reassigned from closing programs to UAV programs. Contractors associated with UAVs with this program would replace those contractors leaving the completed programs; thus the overall personnel requirements would be expected to remain constant.

2.3.2 Alternative B (UAV Flight Operations Limited to Restricted Area R-2515)

The UAV test and evaluation flights shown in Table 2-1 and conducted under Alternative B would operate primarily in restricted area R-2515. Similar to Alternative A, up to 40 percent of the UAV flights would transition to the Sea Range and NTTR via the FAA controlled NAS under a pre-approved COA. This ROI would include restricted area R-2515 and the airspace above Edwards AFB.

All UAV test and evaluation flights would take-off from Edwards AFB and return to Edwards AFB as the final destination. Ground activities and flight activities associated with the implementation of Alternative B are described below.

2.3.2.1 Ground Activities

The UAV ground activities under Alternative B would be the same as discussed in Section 2.3.1.1.

2.3.2.2 Flight Activities

The UAV flight activities under Alternative B would be similar to the activities discussed in Section 2.3.1.2, except the UAVs would be limited to operating in restricted area R-2515.

2.3.2.3 Personnel Requirements

Personnel requirements under Alternative B would be the same as Alternative A and as addressed in Section 2.3.1.3.

2.3.3 Alternative C (UAV Flight Operations Limited to the Airspace Above Edwards AFB)

The proposed UAV test and evaluation flights as shown in Table 2-1 and conducted under Alternative C would primarily occur in the airspace above Edwards AFB. However, similar to Alternatives A and B, UAV flights would also transition to the Sea Range and NTTR via the FAA controlled NAS under a pre-approved COA. Under Alternative C, all UAV test and evaluation flights would take off from Edwards AFB and return to Edwards AFB as the final destination. Ground activities and flight activities associated with the implementation of Alternative C are described below.

2.3.3.1 Ground Activities

The UAV ground activities under Alternative C would be the same as discussed in Section 2.3.1.1.

2.3.3.2 Flight Activities

The UAV flight activities under Alternative C would be the similar to the activities discussed in Section 2.3.1.2, except the UAVs would be limited to operating in the airspace above Edwards AFB.

2.3.3.3 Personnel Requirements

Personnel requirements under Alternative C would be the same as Alternative A and as addressed in Section 2.3.1.3.

2.3.4 Alternative D (No-Action Alternative)

Alternative D (No-Action Alternative) is the status quo. UAV test and evaluation flights would continue to be conducted at the rate and manner currently planned under existing analyses. This would include (among others) such programs as Global Hawk, Predator, UCAV, and other UAV operations similar to manned aircraft flight test operations. These programs would continue to use existing facilities and buildings that would be modified on an as-needed basis. The existing workforce would be sufficient to complete these programs as planned.

2.4 ISSUES AND CONCERNS

During the scoping process, the following issues and concerns were identified as requiring assessment when considering the potential environmental impacts of the alternatives.

- Air Quality. Air pollutant emissions generated from aerospace ground equipment (AGE) and vehicle miles traveled in support UAV test and evaluation flights would be similar to other manned aircraft flight programs.

- Airspace Management and Air Safety. Use of the NAS airspace by UAVs has different rules and requirements than for manned aircraft.

- Hazardous Materials and Waste. The UAVs would use hazardous materials that would generate hazardous waste similar to that from other aircraft flight activities operating from Edwards AFB.

- Natural Resources. Potential impacts to natural habitat may result during test flights; however, these potential impacts would be the same as from other test aircraft using the airspace above these resources.

- Noise. Potential impacts due to traffic and ground and flight activities will be assessed. Noise impacts to wildlife are not anticipated.

- Safety and Occupational Health. Maintenance and flightline personnel could be exposed to hazardous substances while performing routine maintenance activities.

2.5 ISSUES AND CONCERNS CONSIDERED BUT ELIMINATED FROM FURTHER STUDY

The following issues and concerns were initially considered, but subsequently eliminated from further analysis in this EA. No potential for impacts was identified for these resource areas due to the nature of the Proposed Action. Consequently, they will only be briefly addressed below.

- Cultural Resources. Cultural resources could be impacted during flight tests when weapons are used against existing target sites, in areas along the dry lakebed, or during the siting of new facilities; however, since flight tests involving weapons tests would be conducted at existing sites against previously approved targets, no new construction is anticipated, existing facilities would be used, and flight operations would be limited to previously disturbed areas to the maximum extent possible; no significant impacts are anticipated for any of the action alternatives.

- Environmental Justice and Protection of Children. The Executive Orders (EOs) on Environmental Justice and the protection of children require federal agencies to identify and address disproportionately high adverse effects of their activities on minority and low-income populations and children. The proposed activities discussed in this EA were reviewed against EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, and EO 13045, *Protection of Children from Environmental Health and Safety Risks*. Given that no renovation/construction activities are planned for this Proposed Action and other renovation/construction activities would occur entirely on the Base and flight operations would be conducted on preexisting ranges, the U.S. Air Force has determined that this

action would have no substantial, disproportionate impacts on minority and low-income populations and/or children.

- Geology and Soils. The release of weapons on targets and on the ranges are a normal occurrence and would have a less than significant impact on geology and soils. The impact on geology and soil created by flying UAVs over the desert and mountainous terrain would be the same as or less than any other flight vehicle.

- Infrastructure. Testing and evaluation of UAVs are expected to use existing facilities and hangars. Any future changes to existing structures would be evaluated for coverage by existing environmental assessments for modifications to structures on the Base. Additional environmental evaluations would be performed if necessary.

- Land Use. The UAVs could perform test and evaluation flights that release inert weapons (or high explosive bombs at PB-13) or fire lasers at targets on the ranges as identified in test plans reviewed by the Test System Safety Officer and Range Control Office. Targets would be located in designated areas previously evaluated by 95ABW/CEV and approved for testing. No changes to land use are proposed.

- Public/Emergency Services. The primary operating areas for the Proposed Action are on Edwards AFB and within the R-2508 Complex SUA. Access to Edwards AFB is restricted to personnel having a specific need to be on the Base, thus limiting the general access to areas where testing would occur. Approved test plans reviewed by the Test System Safety Officer and Range Control Office would further limit access to test and evaluation operating areas. Provisions for public and emergency services are established for the base and the communities within the R-2508 Complex as necessary to meet the needs of the AFFTC mission; therefore, this action would have no substantial impact on public/emergency services.

- Socioeconomics. The level of support personnel during the program activities would remain constant with the current level of flight test employees. Employees of programs being completed are expected to move to new programs as they begin. Only minor changes in the number of Base employees are expected. Therefore, no impacts to the economy on the Base and in the surrounding communities are expected.

- Water Resources. If not properly managed, the chemicals associated with UAV test and evaluation flight activities could be released into the water systems and have an effect on water quality and water resources. Since implementation of a UAV test and evaluation program would be governed by existing water quality management regulations and management plans, impacts on water resources would be controlled and thus would be less than significant.

2.6 OTHER FUTURE ACTIONS IN THE REGION

Other actions within the region were identified based on review of the *Federal Register*, requests for local permits, and planning documents to determine whether cumulative environmental impacts could result from implementation of the Proposed Action and Alternatives. Cumulative impacts result from "the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." (40 CFR 1508.7).

Other actions within the geographic region of Edwards AFB and the R-2508 Complex were considered to determine their potential for cumulative effects created by other flight test programs. Cumulative effects will be discussed in Chapter 4. Because appropriate range safety requirements are in place to ensure a safe environment to conduct flight tests, along with coordination with the FAA, these actions are not expected to have significant cumulative impacts.

2.7 COMPARISON OF ENVIRONMENTAL IMPACTS

Table 2-3 presents a summary of the significance/mitigation for the Proposed Action and Alternatives. No impacts were identified that are unique to UAVs.

Table 2-3

Summary of Significance/Mitigation for Proposed Action and Alternatives for UAV Flight Operations

Issues	Alternative A	Alternative B	Alternative C	Alternative D
Air Quality	Minor. NO_2: Below the 25 tpy *de minimis* level. NO_2 levels range from 2.31 tpy in 2006 to 8.12 tpy in 2011. VOCs: Below the 25 tpy *de minimis level*. VOCs range from 0.05 in 2006 to 1.71 tpy in 2011. PM_{10}: Below the 70/100 tpy *de minimis* levels. PM_{10}: Ranges from 1.36 tpy in 2006 to 3.95 tpy in 2011.	Minor. NO_2: Below the 25 tpy *de minimis* level. NO_2 levels range from 2.31 tpy in 2006 to 8.12 tpy in 2011. VOCs: Below the 25 tpy *de minimis level*. VOCs range from 0.05 in 2006 to 1.71 tpy in 2011. PM_{10}: Below the 70/100 tpy *de minimis* levels. PM_{10}: Ranges from 1.36 tpy in 2006 to 3.95 tpy in 2011.	Minor. NO_2: Below the 25 tpy *de minimis* level. NO_2 levels range from 2.31 tpy in 2006 to 8.12 tpy in 2011. VOCs: Below the 25 tpy *de minimis level*. VOCs range from 0.05 in 2006 to 1.71 tpy in 2011. PM_{10}: Below the 70/100 tpy *de minimis* levels. PM_{10}: Ranges from 1.36 tpy in 2006 to 3.95 tpy in 2011.	Minor. Below *de minimis* levels. Emission levels would be consistent with current levels.
Airspace Management and Air Safety	Minor. UAV/chase aircraft flights increase by 0.43 percent in 2006 to 1.5 percent in 2011. COA or equivalent required for flight outside special use airspace.	None. UAV/chase aircraft flights increase by 1.1 percent in 2006 to 3.82 percent in 2011. No flight outside of special use airspace planned.	None. UAV/chase aircraft flights increase by 1.69 percent in 2006 to 5.89 percent in 2011. No flight outside of special use airspace planned.	None. COA or equivalent required for flight outside special use airspace.
Cultural	None.	None.	None.	None.
Environmental Justice and the Protection of Children	None	None.	None.	None.
Geology and Soils	None.	None.	None.	None.
Hazardous Waste /Hazardous Materials	Minor. Similar to current HW/HM used for other flight programs in the R-2508. Generation of HW/solid waste would increase by less than 0.2 percent annually.	Minor. Similar to current HW/HM for other flight programs in the R-2515. Generation of HW/solid waste would increase by less than 0.2 percent annually.	Minor. Similar to current HW/HM for other flight programs at Edwards AFB. Generation of HW/solid waste would increase by less than 0.2 percent annually.	Minor. Similar to current HW/HM for other flight programs.
Infrastructure	None.	None.	None.	None.
Land Use	None.	None.	None.	None.
Natural Resources	Minor. Similar to current natural resources impacts for other flight operations in the R-2508.	Minor. Similar to current natural resources impacts for other flight operations in the R-2515.	Minor. Similar to current natural resources impacts for other flight operations at Edwards AFB.	Minor. Similar to current Natural resources impacts for other flight operations in the Edwards AFB. Comply with mitigation measures in INRMP and USFWS Biological Opinions.

Table 2-3, Page 1 of 3

Table 2-3 (Continued)

Summary of Significance/Mitigation for Proposed Action and Alternatives for UAV Flight Operations

Issues	Alternative A	Alternative B	Alternative C	Alternative D
Natural Resources (Continued)	UAVs would normally launch and land at previously disturbed areas not critical T&E habitat. Up to 5 percent of the flight activity would occur below 3,000 feet AGL. Project personnel and flight activities would comply with mitigation measures in INRMP and USFWS Biological Opinions.	UAVs would normally launch and land at previously disturbed areas not critical T&E habitat. Up to 5 percent of the flight activity would occur below 3,000 feet AGL. Project personnel and flight activities would comply with mitigation measures in INRMP and USFWS Biological Opinions.	UAVs would normally launch and land at previously disturbed areas not critical T&E habitat. Up to 5 percent of the flight activity would occur below 3,000 feet AGL. Project personnel and flight activities would comply with mitigation measures in INRMP and USFWS Biological Opinions.	
Noise	Minimal. Subsonic noise levels increase by 0.1 dB. Acceptable noise level for supersonic flights is 61 dBC. If 20 percent of UAV flights were supersonic; the CDNL levels for impulse noise would increase from current level of 57.5 dBC to 58.6 dBC; a value below the acceptance level. Sensitive noise areas would be avoided or over flown above 2,000 feet AGL. Less than 2-dBA increase in DNL. Hearing protection required for flightline maintenance personnel.	Minimal. Subsonic noise levels increase by 0.1 dB. Acceptable noise level for supersonic flights is 61 dBC. If 20 percent of UAV flights were supersonic; the CDNL levels for impulse noise would increase from current level of 57.5 dBC to 58.6 dBC; a value below the acceptance level. Sensitive noise areas would be avoided or over flown above 2,000 feet AGL. Less than 2-dBA increase in DNL. Hearing protection required for flightline maintenance personnel.	Minimal. Subsonic noise levels increase by 0.1 dB. Acceptable noise level for supersonic flights is 61 dBC. If 20 percent of UAV flights were supersonic; the CDNL levels for impulse noise would increase from current level of 57.5 dBC to 58.6 dBC; a value below the acceptance level. Sensitive noise areas would be avoided or over flown above 2,000 feet AGL. Less than 2-dBA increase in DNL. Hearing protection required for flightline maintenance personnel.	Minimal. Similar to noise profiles for other flight programs at Edwards AFB. Hearing protection required for flightline maintenance personnel.
Public/ Emergency Services	None.	None.	None.	None.
Safety and Occupational Health	Minor. Safety and Occupational Health impacts similar to other flight programs. Pilot in command would require special training and could operate only one UAV at a time. Flightline maintenance personnel would be trained on specifics of new aircraft.	Minor. Safety and Occupational Health impacts similar to other flight programs. Pilot in command would require special training and could operate only one UAV at a time. Flightline maintenance personnel would be trained on specifics of new aircraft.	Minor. Safety and Occupational Health impacts similar to other flight programs. Pilot in command would require special training and could operate only one UAV at a time. Flightline maintenance personnel would be trained on specifics of new aircraft.	Minor. Safety and Occupational Health impacts similar to other flight programs. Pilot in command would require special training and could operate only one UAV at a time. Flightline maintenance personnel would be trained on specifics of new aircraft.

Table 2-3, Page 2 of 3

Table 2-3 (Continued)

Summary of Significance/Mitigation for Proposed Action and Alternatives for UAV Flight Operations

Issues	Alternative A	Alternative B	Alternative C	Alternative D
Safety and Occupational Health (Continued)	Hearing protection will be required for flightline maintenance personnel in areas where noise exceeds 85 dBA.	Hearing protection will be required for flightline maintenance personnel in areas where noise exceeds 85 dBA.	Hearing protection will be required for flightline maintenance personnel in areas where noise exceeds 85 dBA.	
Socioeconomics	None.	None.	None.	None.
Water Resources	None.	None.	None.	None.

Table 2-3, Page 3 of 3

Notes: **Significance Levels**

None: There are no impacts expected.

Minimal: The impacts are not expected to be measurable, but are within the capacity of the impacted system to absorb the change, or the impacts can be compensated for with little effort and resources so the impact is not substantial.

Minor: The impacts are measurable, but are within the capacity of the impacted system to absorb the change, or the impacts can be compensated for with little effort and resources so the impact is not substantial.

Flight activity in 2011 is higher than 2012; therefore for summary purposes, the data for 2011 are shown as the worst case comparison.

Abbreviations

AGL – above ground level
CDNL – C-weighted day-night level
dB – decibel
dBA – A-weighted decibel
dBC –C-weighted decibel
DNL – day-night level
HM/HW – hazardous materials/hazardous waste
INRMP – Integrated Natural Resources Management Plan
NO2 – nitrogen dioxide
POLs – petroleum, oils, and lubricants
PM_{10} – particulate mater less than 10 micron in diameter
T&E – threatened and endangered
tpy – tons per year
UAV – unmanned aerial vehicle
USFWS – U.S. Fish and Wildlife Service
VOCs – volatile organic compounds

3.0 AFFECTED ENVIRONMENT

This chapter describes existing environmental conditions likely to be affected by Alternatives A, B, C, and D. The ROI primarily consists of Edwards AFB, the R-2508 Complex, and flight routes between the Sea Range and NTTR. The ROI for each action will be discussed in terms of these regions.

Environmental resources and impacts for these ROIs have been discussed in detail in the following documents that are part of the public record:

- *Environmental Baseline Study R-2508 Complex*, 95th Air Base Wing and Air Force Flight Test Center, Environmental Management Office, Edwards Air Force Base, California 93524-1134. 2005.
- *Environmental Resource Document*, National Aeronautics and Space Administration, Dryden Flight Research Center, Edwards Air Force Base, California 93523. June 2003.
- *Environmental Assessment for Armed Munitions Integration Testing on the Precision Impact Range Area*. Air Force Flight Test Center, Environmental Management Office, Edwards Air Force Base, California 93524-1134. May 2005.
- *Environmental Assessment for the Continued Use of Restricted Area R-2515*. Air Force Flight Test Center, Environmental Management Office, Edwards Air Force Base, California 93524-1134. 1998.
- *Environmental Assessment to Extend the Supersonic Speed Waiver for Continued Operations in the Black Mountain Supersonic Corridor and Alpha Corridor/Precision Impact Range Area.* Air Force Flight Test Center, Environmental Management Office, Edwards Air Force Base, California 93524-1134. April 2001.
- *Environmental Assessment for Low-Level Flight Testing, Evaluation, and Training,* Air Force Flight Test Center, Edwards AFB, California 93524-1134. May 2005.
- *Final Integrated Natural Resources Management Plan for Edwards Air Force Base, California,* Edwards AFB Plan 32-7064, Edwards Air Force Base, California 93524-1134. 2004.

- *Environmental Impact Statement for Proposed Military Operational Increases and Implementation of Associated Comprehensive Land Use and Integrated Natural Resources Management Plans.* Naval Air Weapons Station China Lake, California and The Bureau of Land Management, Ridgecrest, California 2003.

- *Environmental Assessment for Predator Force Structure Changes at Indian Springs Air Force Auxiliary Field, Nevada*, U.S. Air Force, Air Combat Command. July 2003.

- *Environmental Assessment/F-22 Initial Operational Test and Evaluation*. U.S. Air Force, Air Force Center for Environmental Excellence, San Antonio, Texas. September 2001.

Based on the assessment of the Proposed Action and Alternatives and the data in the above references, it was determined that there is a potential for the following resources to be affected: air quality, airspace management and air safety, hazardous materials/waste, natural resources, noise, and safety and occupational health.

3.1 AIR QUALITY

Air quality in a given location is defined by the concentration of various pollutants in the atmosphere. By comparing a pollutant concentration in the atmosphere to federal and/or state ambient air quality standards, the significance of its presence can be determined. Supplemental air quality data are provided in Appendix A; national and state ambient air quality standards for California and Nevada are shown in Appendix A, Table A.1-1.

A summary of attainment designations for the various air basins in the ROI show that Inyo County/Great Basin Unified Air Basin (GBUAB) is the only air basin in attainment for ozone for national standards. All other air basins in the ROI are in non-attainment for ozone, except the eastern portion of Kern County which is now in maintenance for the national standards, and Inyo County/GBUAB, which is unclassified for the California standards. All air basins in the ROI are in attainment, unclassified/attainment, or unclassified for carbon monoxide (CO), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2). All air basins in the ROI are in non-attainment for particular matter equal to or less than 10 microns in diameter (PM_{10}) standards except for the Los Angeles/Mojave Desert Air Basin (MDAB) which is unclassified for the national PM_{10} standards and Kern County which is unclassified for the California PM_{10} standard. The current attainment status for each county/air basin in the ROI is shown in Appendix A, Table A.1-3.

The U.S. EPA typically uses 3,000 feet AGL as the default mixing height that inhibits the rapid vertical transfer of air. Pollutants emitted above the mixing height become diluted in the very large volume of air in the troposphere before they are slowly transported down to ground level. These emissions have little or no effect on ambient air quality. Therefore, air quality impacts below 3,000 feet AGL are the emphasis of the air quality assessment analysis. The majority of emissions from criteria air pollutants, or precursors thereof, for the Proposed Action and Alternatives are expected to occur above the mixing height of 3,000 feet AGL. Approximately 5 percent of UAV related events would generate emissions below 3,000 feet AGL and would be associated with takeoff and landing at Edwards AFB.

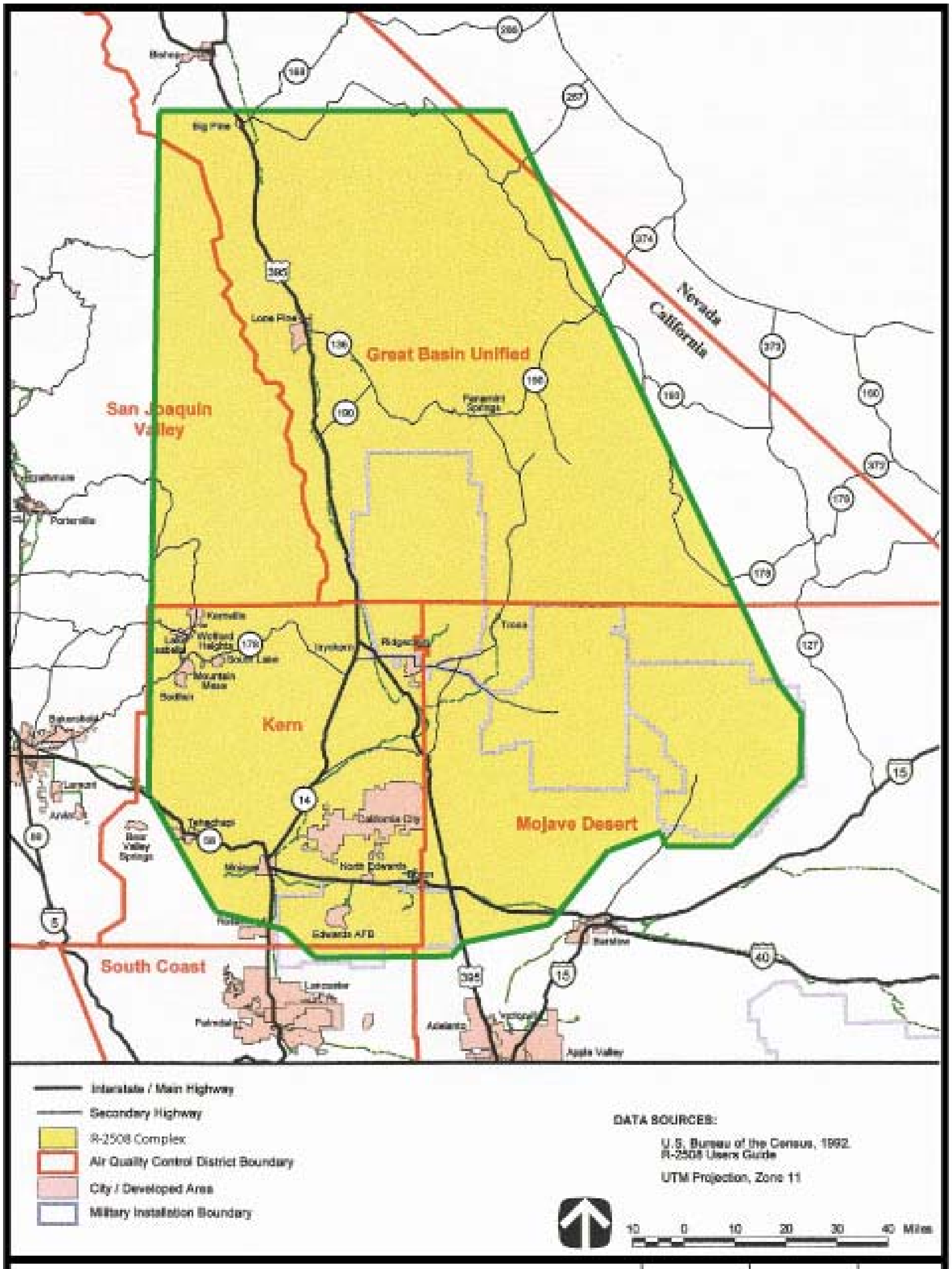
3.1.1 Alternative A (UAV Flight Operations Within the R-2508 Complex) (Proposed Action)

The Proposed Action, Alternative A, proposes the use of the entire R-2508 Complex area for testing. Air emissions above and below 3,000 feet AGL would occur. The climate of the R-2508 Complex area is described in the *R-2508 Environmental Baseline Study* completed in August 1997 and updated in 2005(95 Air Base Wing [ABW] and Air Force Flight Test Center [AFFTC] 2005a).

The R-2508 Complex extends into portions of Kern, Tulare, Fresno, Inyo, Los Angeles, and San Bernardino Counties and spans three air basins including the MDAB, the San Joaquin Valley Air Basin, and the Great Basin Valleys Air Basin. Four local air districts maintain jurisdiction over the area: the Kern County Air Pollution Control District (KCAPCD), the San Joaquin Valley Air Pollution Control District (SJVAPCD), the Great Basin Unified Air Pollution Control District, and the Mojave Desert Air Quality Management District (MDAQMD) (Figure 3-1).

3.1.2 Alternative B (UAV Flight Operations Limited to Restricted Area R-2515)

Restricted area R-2515, which is a subset of the R-2508 Complex, extends into portions of Kern, Los Angeles, and San Bernardino Counties and is part of the MDAB, which includes local air districts that maintain jurisdiction over the area: the KCAPCD, the Antelope Valley Air Quality Management District (AVAQMD), and the MDAQMD. The majority of the region is in non-attainment of both state and national standards for PM_{10} and ozone. It should be noted that the eastern portion of Kern County was recently designated as in attainment of the national 1-hour ozone standard but remains in nonattainment of both the national 8-hour ozone standard and the state standard.



Air Quality Control Districts in the R-2508 Complex | Figure 3-1 | Q267-04 | 11/06/05

Figure 3-1

Air Quality Control Districts in the R-2508 Complex

Therefore, this area was still considered a non-attainment area for ozone when conducting the screening process to determine applicability of the conformity guidelines. The area is in attainment or unclassified for the remaining criteria pollutants including CO, NO_2, and SO_2.

Eastern Kern County is located on the western edge of the Mojave Desert and is separated from populated valleys and coastal areas to the west and south by several mountain ranges. These valleys and coastal areas are the major source of ozone precursor emissions affecting ozone exceedances within Kern County's part of the MDAB. Although the sources of pollution in eastern Kern County do not by themselves result in exceedances of the federal ozone standards, this region is largely impacted by ozone transport from both the San Joaquin Valley Air Basin and the South Coast Air Basin.

Elevated levels of PM_{10} are primarily associated with fugitive dust, which is produced through a combination of high winds, dry soil conditions resulting from an arid climate, and ground-disturbing activities such as mining, agriculture, and construction.

3.1.3 Alternative C (UAV Flight Operations Limited to the Airspace Above Edwards AFB)

The main base at Edwards AFB is located in the eastern portion of Kern County, which is under the jurisdiction of the KCAPCD and is the largest contributor to air emissions. Because those activities proposed herein that could impact air quality would mainly occur on the main base, discussions of environmental effects to air quality are analyzed in relation to baseline air quality in the KCAPCD. Table 3-1 provides a summary of aircraft emissions at Edwards AFB in 2004 for comparison to the flights associated with flight tests of UAV systems. These are baseline quantities for emissions below the mixing layer of 3,000 feet AGL for operations occurring on Edwards AFB.

Table 3-1

Summary of Existing Emissions at Edwards AFB (tons/year)

VOC	CO	NO_x	SO_2	PM_{10}
204.82	457.55	195.82	18.63	11.95

Notes: Represents emissions that occurred in 2004 (Air Force Flight Test Center 2005a).
CO – carbon monoxide
NO_x – nitrogen oxides
PM_{10} – particulate matter equal to or less than 10 microns in diameter
SO_2 – sulfur dioxide
VOC – volatile organic compound

The MDAB is currently impacted by fugitive dust emissions. Edwards AFB is situated in the MDAB portion of Kern County; therefore, current and forecasted baseline emissions, including PM_{10} emissions, for this portion of Kern County are listed in Table 3-2.

Table 3-2

MDAB Portion of Kern County

Baseline and Forecasted Emission Baseline (tons/year)

Year	VOC	NO_x	PM_{10}
1985[a]	8,395	9,855	9,855
1990[a]	7,665	14,235	16,060
1995[a]	4,745	10,585	10,585
2000[a]	4,380	11,315	11,315
2005[b]	4,380	10,950	12,410
2010[b]	4,015	10,950	13,505

Notes: a- actual
b – estimated
NO_x – nitrogen oxides
PM_{10} – particulate matter equal to or less than 10 microns in diameter
VOC – volatile organic compound

Source: California Environmental Protection Agency 2005.

3.2 AIRSPACE MANAGEMENT AND AIR SAFETY

This Section provides a brief overview of the airspace and air safety measures for the affected environment. A detailed description can be found in Appendix B and the R-2508 Users Handbook which can be accessed at http://r2508.edwards.af.mil/Downloads/index.html.

The primary airspace affected by the Proposed Action and Alternatives is the airspace within the R-2508 Complex; 20,000 square miles that extends for 140 miles north to south (Bishop, California, to Edwards AFB, California) and 110 miles east to west (Nevada state line to Bakersfield, California). There are 7 restricted areas and 11 military operating areas within the R-2508 Complex (Figure 3-2).

The airspace is scheduled, monitored, regulated, and controlled to provide safe aircraft test areas. The average number of flights ranges from approximately 120 per day over the entire R-2508 Complex to approximately 24 per day at Edwards AFB. Flights include low-level test and training flights along pre-established routes, flight tests within the restricted areas and military operating areas, and flights transitioning to other FAA controlled airspace. Supersonic flights are routinely conducted, but occur only over approved areas. Only one established commercial air traffic route transects the R-2508 Complex; however, that route is normally closed during daylight hours on Monday through Friday. There are 16

small airports or airfields and two military airfields (Edwards AFB and NAWS China Lake) within the R-2508 Complex. Flight activity within the R-2508 Complex SUA is controlled by the FAA.

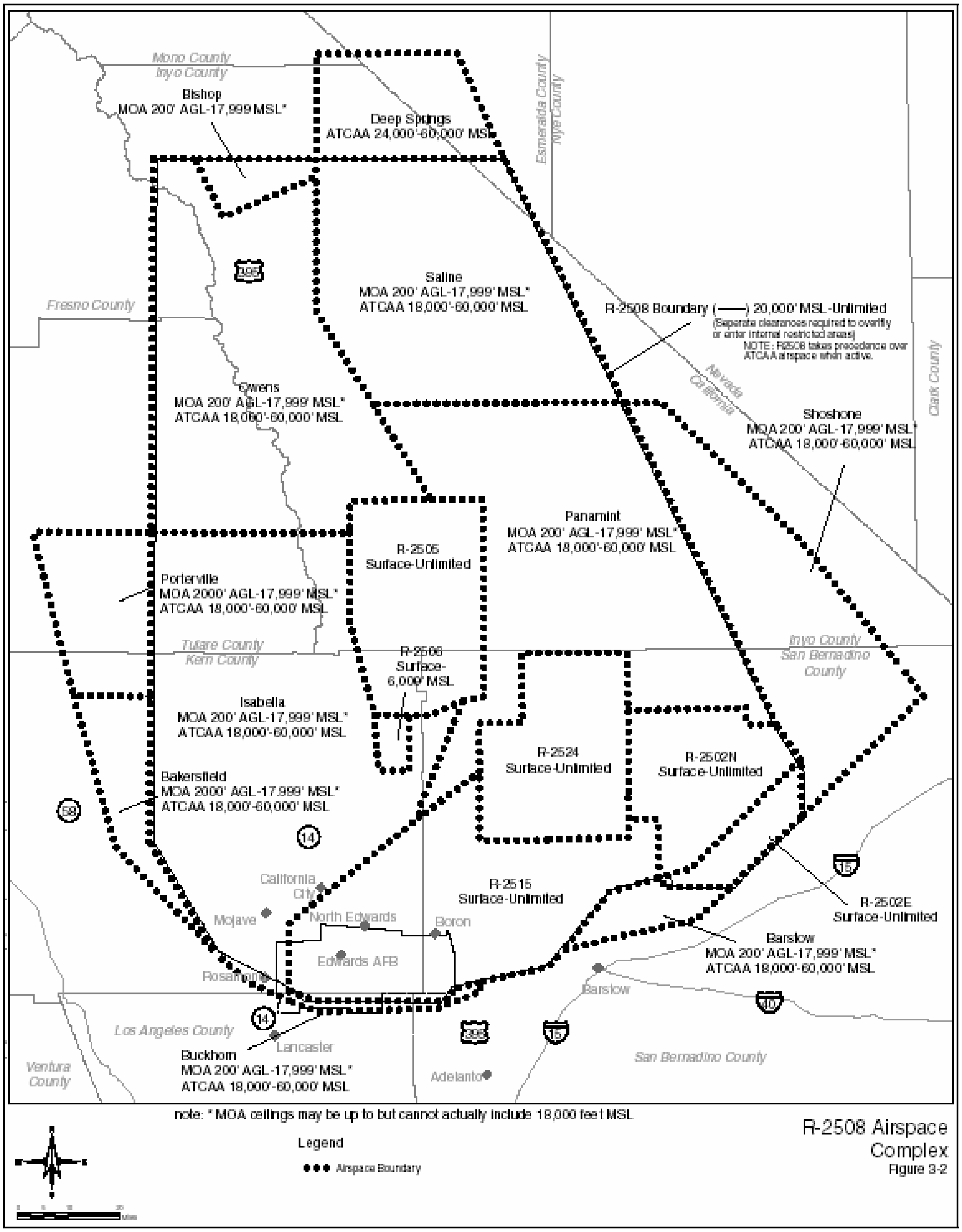


Figure 3-2

Areas of Controlled Airspace for the Proposed Action and Alternatives

3.3 HAZARDOUS MATERIALS AND HAZARDOUS WASTE

For purposes of this analysis, the terms “hazardous material” and “hazardous waste” are those substances defined by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 and the Resource Conservation and Recovery Act.

A hazardous material is any material whose physical, chemical, or biological characteristics, quantity, or concentration may cause or contribute to adverse effects in organisms or their offspring; pose a substantial present or future danger to the environment; or result in damage to or loss of equipment, property, or personnel. Hazardous wastes are substances that have been “abandoned, recycled, or are inherently waste like,” and that (because of their quantity, concentration, or characteristics) may cause increases in mortality or serious irreversible illness, or pose a substantial hazard to human health or environment if improperly treated, stored, transported, or disposed of.

Solid waste refers to non-hazardous garbage, refuse, sludge, and any other discarded solid material resulting from residential, commercial, and industrial activities or operations. Solid waste can be classified as construction/demolition waste, non-hazardous recyclable waste, or non-hazardous non-recyclable waste.

3.3.1 Alternatives A, B, and C (Flight Operations in the R-2508 Complex, Restricted Area R-2515, and Edwards AFB)

The only significant quantities of hazardous materials, hazardous waste, and solid waste occurring in the R-2508 Complex originating from AFFTC and NASA DFRC flight operation are managed, used, and disposed of at Edwards AFB. Edwards AFB, including NASA DFRC, uses a wide variety of hazardous materials in support of research activities on base and its mission requirement to support all types of aircraft. Hazardous materials are used for aircraft repair and maintenance, aircraft launch and recovery, aerospace ground equipment repair and maintenance, building remodeling, and construction. Some of the most commonly used hazardous materials include jet and motor fuel, other types of petroleum products, paints, thinners, adhesives, cleaners, lead-acid batteries, hydraulic fluids, and halogenated and non-halogenated solvents (U.S. Air Force 1995b).

Hazardous materials are used to support rocket propulsion research and development at the AFRL. Typical hazardous materials used include liquid and solid rocket propellants. Other hazardous materials

used at the AFRL include batteries, antifreeze, cleaning/degreasing solvents, and machinery lubricants, which are used in component fabrication, repair, maintenance, and assembly operations (AFFTC 1998a).

Building and facility maintenance requires the use of heating fuels, paints, aerosols, and fluorescent light bulbs, all of which are hazardous materials.

Edwards AFB and NASA DFRC use the pharmacy concept to issue hazardous materials for use by all personnel. Implementation of the Hazardous Materials Pharmacy approach in the 1980s accomplished several important management goals, including reducing the volume of hazardous materials purchased and hazardous wastes generated through improved materials management. The Hazardous Materials Pharmacy monitors shelf life and tracks usage of hazardous materials on base. One common database is used to manage issued hazardous material products. Hazardous materials purchased through the pharmacy are bar code labeled upon their arrival at Supply Central Receiving and distributed to the various satellite issue points or Hazardous Materials Distribution Support Centers located throughout Edwards AFB.

All organizations and contractors are required to maintain inventories of all their hazardous materials. Furthermore, organizations are required to reduce the quantity of hazardous materials used or replace them with non-hazardous material, if possible, as a part of the Pollution Prevention Program. Guidelines used by Edwards AFB include AFI 32-7086, *Hazardous Materials Management*; AFI 32-7042, *Solid and Hazardous Waste Compliance*; and AFFTCI 23-1, *Hazardous Material Management Program.*

3.4 NATURAL RESOURCES

Biological resources are defined as terrestrial and aquatic ecosystems along with the native plants and animals that occur throughout these ecosystems. This includes plant populations and communities; wildlife populations and their relationship to habitat; and aquatic habitat and riparian ecosystems. Plant and animal species that are proposed for, candidates for, or are listed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS), and species having equivalent status at the California state level, are referred to as special-status species and are given special consideration by law for their preservation. The USFWS identifies primary physical and biological constituent elements of an area designated as critical habitat that are essential to the conservation of the species (50 CFR 424.12). Primary constituent elements may include, but are not limited to, roost sites, nesting grounds, spawning sites, feeding sites, seasonal wetlands or drylands, water quality or quantity, host species or plant pollinators, geological formations, vegetation types, tides, and specific soil types (50 CFR 424.12). This

section provides a brief summary of natural resources that may be encountered by implementing the Proposed Action and Alternatives. Additional information and details are provided in the *Final Integrated Natural Resources Management Plan for Edwards Air Force Base, California* (Edwards AFB 2004).

Under Section 7 of the Endangered Species Act (ESA), consultation with the USFWS is required for federal projects if impacts may affect listed species or critical habitat; conference is required if such action is likely to jeopardize the continued existence of a proposed species or to adversely modify proposed critical habitat. The Air Force developed management goals and objectives as specified in Integrated Natural Resource Management Plan (INRMP) as required by the Sikes Act. This INRMP provides guidance for protecting sensitive species, sensitive communities, and habitats recognized by state and local agencies when evaluating impacts of a project.

3.4.1 Alternatives A, B, and C (Flight Operations in the R-2508 Complex, Restricted Area R-2515, and Edwards AFB)

The following sections provide an overview of the plants and wildlife found within the R-2508 Complex. A detailed description of the species can be found in the following public documents: *R-2508 Complex Environmental Baseline Study* (95 ABW and AFFTC 2005a), *Integrated Natural Resources Management Plan for Edwards AFB, California* (Edwards AFB 2004), and Appendix C.

3.4.1.1 Plants

Plant communities within most of the R-2508 Complex include species that are adapted to the environments of the Mojave Desert. These include creosote bush scrub, Joshua tree woodland, arid-phase saltbush, halophytic phase saltbrush scrub, xerophytic saltbrush scrub, and mesquite woodland. The western portion of the R-2508 Complex overlies the Sierra Nevada Range and a portion of the San Joaquin Valley. The vegetation in these regions is substantially different from the xeric vegetation found within the Mojave Desert. Mountain slope elevation and the accompanying microclimate gradient results in a zonation of plant communities on the east- and west-facing slopes. The elevation distribution of plant communities largely accounts for the habitat variety found on the land under the boundaries of the R-2508 Complex.

Several coniferous forest types occur in the Sierra Nevada Range. Sub-alpine forests are dominated by high-elevation pines and alpine habitats at high elevations in the Sierra Nevada Range. Foothill grasslands are dominated by various grass species. Foothill woodlands are dominated by oaks at lower

elevations and certain pines at upper elevations on the western side of the Sierra Nevadas. Various non-desert scrub communities are also common in the ROI. Scrub communities found within the ROI include shadscale scrub, chaparral, and sage-grass (also known as sagebrush grassland).

3.4.1.2 Wildlife

Wildlife species occurring within the ROI include species adapted to a variety of habitats. Several federally and state-protected species that may be found within the ROI are discussed in the Threatened and Endangered Species section and Appendix C.

Wildlife within the Mojave Desert includes native species of rats, bats, mice, coyotes, and bobcats. Reptiles common to all desert habitats include lizards, whiptails, boas, and rattlesnakes.

The Migratory Bird Treaty Act and EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*, identify requirements for the protection of migratory birds. Migratory birds will use airspace that would be used by the UAVs under the Proposed Action and Alternatives. Birds are very mobile species and tend to occupy favored habitats within their range. Common bird species found within the R-2508 Complex include the red-tailed hawk, killdeer, white-crowned sparrow, turkey vultures, ravens, chickadees, warblers, nutcrackers, sapsuckers, larks, orioles, vireos, magpies, kites, scrub jays, wrentits, wrens, woodpeckers, flickers, owls, bushtits, and meadowlarks. Large birds and bird flocks are known to present hazards to aircraft, typically below 5,000 feet AGL in elevation, depending upon local terrain.

Amphibians typically found in the R-2508 Complex include salamanders, toads, and frogs. Seasonal migrants include bluebirds, dark-eyed juncos, and white-crowned sparrows. Mammals found in the R-2508 Complex habitats include black bear, mountain lions, rabbits, foxes, woodrats, weasels, squirrels, mule-deer, bats, and yellow-bellied marmots.

Threatened and Endangered Species

A number of federally and state-listed threatened and endangered animal species are known to be present in the ROI.

The desert tortoise inhabits the Mojave, Colorado, and Sonoran deserts in the southwestern United States and adjacent areas in Mexico. The species is geographically divided by the Colorado River into the

Sonoran and Mojave populations. The Mojave population was formally listed as threatened by the USFWS in 1990.

Fishes protected by endangered species regulations include the state- and federally listed as endangered Owens tui chub and the Owens pupfish, and the state-listed as threatened cottonball marsh pupfish (Air Force Center for Environmental Excellence 2001).

The federally listed as threatened western snowy plover inhabits shores of ephemeral lakes and perennial waters of the desert, and has been recorded at Rosamond Dry Lake on Edwards AFB and at Harper Dry Lake and Koehn Dry Lake (Air Force Center for Environmental Excellence[AFCEE] 2001). The federally listed as endangered and state-listed as threatened Yuma clapper rail is a resident in shallow, freshwater marshes with dense stands of cattails and bulrushes (AFCEE 2001). The federally and state-listed as endangered Least Bell's vireo is restricted to riparian areas containing dense willow thickets; its breeding range in the ROI is restricted to an area along the Amaragosa River. The Inyo California towhee inhabits only the Argus Mountains of southern Inyo County.

The Amaragosa vole is a small rodent that inhabits the Amaragosa River drainage; it is federally and state listed as endangered. Several other species of concern may occur in the Mojave Desert portion of the ROI, including the state-threatened Mohave ground squirrel. Two federally listed as threatened fish species occur within the Sierra Nevada portion of the ROI. Little Kern golden trout inhabits the Little Kern River tributary of the Kern River. The Lahontan cutthroat trout is a rare trout found on the eastern side of the Sierra Nevada.

One amphibian, the California red-legged frog, a federally listed as threatened species, occurs in the foothill and montane portions of the Sierra Nevada. A state-listed as threatened reptile, the Southern rubber boa, inhabits an area west of Lake Isabella (AFCEE 2001). The American peregrine falcon is state listed as endangered. This raptor (bird of prey) nests on cliffsides and on other rock outcrop areas. The great gray owl and willow flycatcher are listed as endangered by the state of California and occur in coniferous and willow riparian forests, respectively. Another state-listed as endangered bird, the western yellow-billed cuckoo, occurs in riparian forests along the Kern River. It is also found in a small area along the Amaragosa River in the Mojave Desert.

California bighorn sheep, federally and state-listed as endangered, are residents of the most remote mountain wilderness areas within the ROI. Several species listed as threatened by the state of California occur within the Sierra Nevada portion of the ROI. The Kern Canyon slender salamander is found only in

the canyons of the lower Kern River. The wolverine rarely resides in the remote high Sierra Nevada habitats. The Sierra Nevada red fox is a seldom-seen nocturnal predator in this region.

Valley elderberry longhorn beetle is a federally listed as threatened insect distributed within elderberry-dominated drainages throughout the San Joaquin Valley. The blunt-nosed leopard lizard is both state- and federally listed as endangered, and occurs in sparsely vegetated plains and foothills. The Aleutian Canada goose is a federally listed as threatened species that winters in the San Joaquin Valley. The San Joaquin kit fox is federally listed as endangered and state listed as threatened, and occurs in grasslands from Tracy south to southern Kern County. The giant kangaroo rat and Tipton kangaroo rat are both state and federally listed as endangered species. The giant kangaroo rat occurs on or just outside the western limits of the R-2508 Complex in Kern County. The Tipton kangaroo rat once ranged throughout much of the southern San Joaquin Valley. Its populations are currently restricted to just several sites in the southern portion of that valley. State-listed species occurring in the ROI include the threatened San Joaquin antelope squirrel found only in the southern San Joaquin Valley. Swainson's hawk and bank swallow are both listed as state threatened, and although uncommon, nest at sites throughout the San Joaquin Valley.

Kern primrose sphinx moth is federally listed as threatened and is known only from a 5-acre area in the Walker Basin east of Bakersfield. The California condor is both federally and state listed as endangered but has been essentially extirpated from the wild. Efforts to reintroduce this species into the wild are currently underway. The Tehachapi slender salamander is state listed as threatened, with a distributional range that is restricted to an area between Piute Mountain and Tejon Pass.

Sensitive Habitats

Desert tortoise critical habitat is present within the ROI. Important habitat for desert bighorn sheep and species identified in the Threatened and Endangered Species section also occurs within the ROI. Some pools and drainages are the only habitat for certain fish species, such as pupfish. Two sensitive ecological areas, as defined by the county of Los Angeles, occur within Edwards AFB: Piute Ponds, in the southwestern corner of the base, supports a significant number of waterfowl and provides a stopover area for migratory birds. Mesquite woodlands, in the south-central portion of Edwards AFB, provide a unique habitat for wildlife such as phainopepla and loggerhead shrike.

3.5 NOISE

In 1972, Congress enacted the Noise Control Act (NCA), Public Law 92-574. Among the requirements under NCA was a directive to the U.S. EPA to "…publish information on the levels of environmental noise, the attainment and maintenance of which in defined areas under various conditions as requisite to protect the public health and welfare with an adequate margin of safety." The U.S. Environmental Protection Agency (U.S. EPA) published EPA-550/9-47-004, *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*, in 1974 (Levels Document) (U.S. EPA 1974). The characteristics of sound are addressed in Appendix D, Noise Background and Analysis.

3.5.1 Alternatives A, B, and C (Flight Operations in the R-2508 Complex, Restricted Area R-2515, and Edwards AFB)

The land under the R-2508 Complex consists primarily of open space, but includes industrial, residential, commercial, and public/recreation centers as well. Noise estimates are usually presented as noise contours. Noise contours are lines on a map of an airfield and its vicinity where the same noise level is predicted to occur. The 5-decibel (dB) interval chosen to represent noise contours reflects the Department of Housing and Urban Development (HUD) noise criteria commonly used for airfield noise. Road noise varies from 60 to 90 A-weighted decibel (dBA) depending on the type and quantity of traffic. The Military Operations Area (MOA) Range NOISEMAP (MR_NMAP) noise model was used to develop the ambient noise contours for the R-2508 Complex. The models in MR_NMAP together are representative of the way aircraft fly in military airspace. There are three general representations: broadly distributed operations that generally occur in MOAs and ranges, distributed parallel tracks that occur along military training routes, and specific tracks that occur in target areas. The noise models contained in MR-NMAP assume operations in MOAs and restricted airspace areas are uniformly distributed which accounts for noise contours following the borders of the airspace (Lucas and Calamia 1996).

3.5.1.1 R-2508 Complex

The total noise contours include the effects of distributed aircraft operations and that of low level and other test routes that lie within the R-2508 Complex. The day-night sound levels on the A-weighted decibel scale (L_{dn}) noise contours resulting from subsonic aircraft operations range from 45 to 60 dBA (up to 65 dBA at Ft. Irwin) within the R-2508 Complex (95 ABW and AFFTC 2005). The ambient noise levels around military airfields range from 45 dBA to 80 dBA, but lie completely within the base boundaries. Sensitive noise areas within the R-2508 Complex are shown in Figure 3-3.

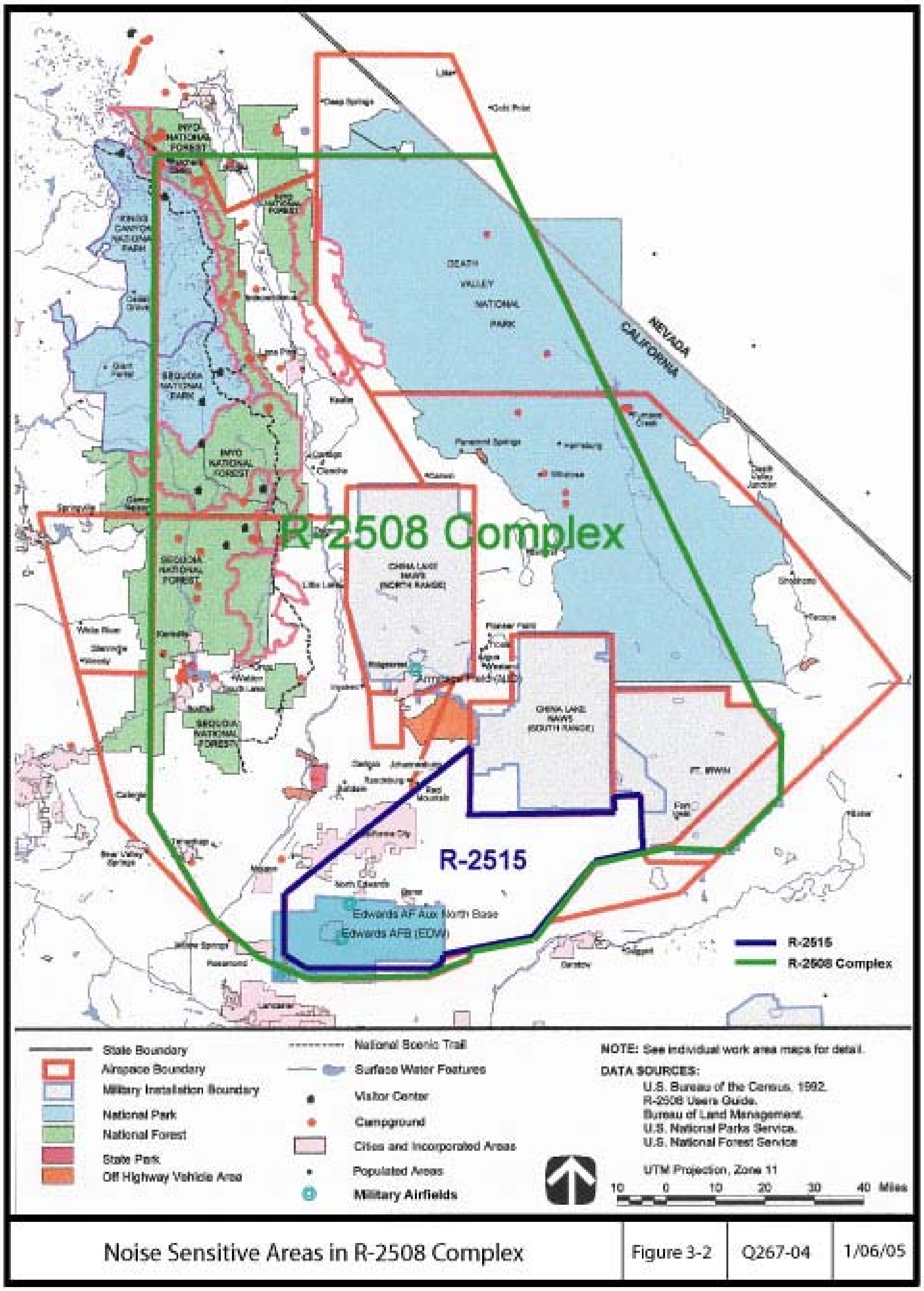


Figure 3-3

Sensitive Noise Areas in the R-2508 Complex

This figure summarizes the noise receptors as associated with land use for national and state parks, national forests, recreational areas, cities, and incorporated areas including schools, hospitals, and residential areas. Additional detailed information can be found in the *R-2508 Complex Environmental Baseline Study* (95 ABW and AFFTC 2005a).

3.5.1.2 Restricted Area R-2515 and Edwards AFB

The L_{dn} noise contours resulting from subsonic aircraft operations in restricted area R-2515 range from 55 dB L_{dn} to less than 45 dB L_{dn} (95 ABW and AFFTC 2005a); therefore no noise above 60 dB L_{dn} would be expected in restricted area R-2515. The highest noise levels are found in the area of Cords Road, the Alpha Corridor, and the Precision Impact Range Area (PIRA).

Noise contours for Edwards AFB as shown in Figure 3-4 were updated in 2004. The noise is highest around the airfield, NASA DFRC, and industrial areas. The noise levels near the residential areas and at the perimeter of the Base remain below 65 dB Community Noise Equivalent Level (CNEL).

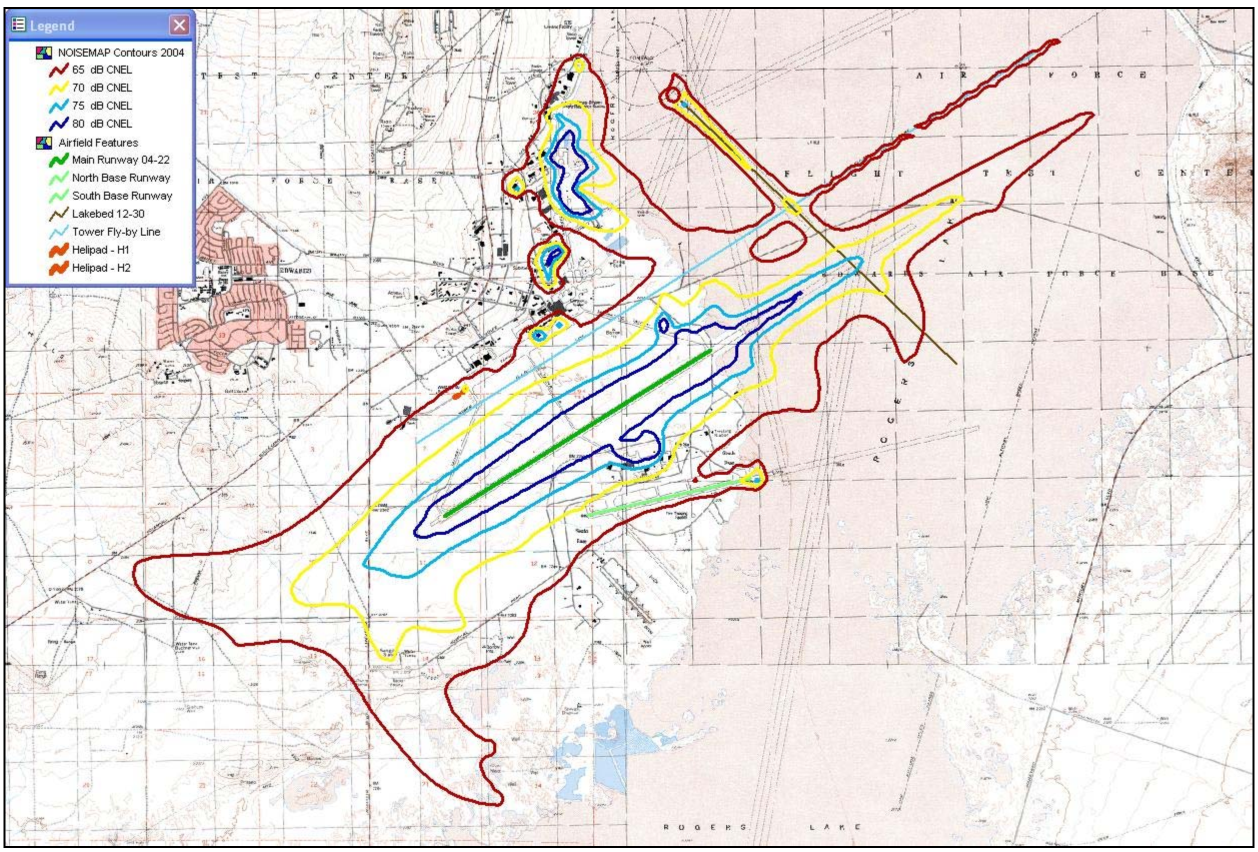


Figure 3-4

Noise Contours at the Runways at Edwards AFB

3.5.1.3 Noise From Sonic Booms

Noise from sonic booms is addressed in the *Environmental Assessment to Extend the Supersonic Waiver for Continued Operations in the Black Mountain Supersonic Corridor and Alpha Corridor/Precision Impact Range* (AFFTC 2001) and the *Environmental Assessment for the Continued Use of Restricted Area R-2515* (AFFTC 1998b). Supersonic noise in the R-2515 restricted airspace is generated from supersonic flight operations occurring in the Black Mountain and High Altitude supersonic corridors and Alpha Corridor/PIRA area. The predicted cumulative noise level contours for current operations in these corridors are based on 1999–2000 data. Aircraft traveling at or above sonic velocity produce sonic booms with a noise level of 61 dB L_{cdn} and below within restricted area R-2515 (95 ABW and AFFTC 2005a). It was estimated that approximately 740 supersonic flights were conducted on the Edwards supersonic corridors in 1999. Of those flights, 10 supersonic flights occurred between 500 feet AGL and 10,000 feet above MSL, 151 supersonic flights occurred between 10,000 and 30,000 feet above MSL, and 579 supersonic flights occurred above 30,000 feet above MSL. Overpressures for the majority of sonic booms run a nominal 1.3 pounds per square foot (psf) (AFFTC 2001). Two factors that help determine the levels of annoyance for sonic booms are frequency and sound level. Table 3-3 shows the relationship between C-weighted and A-weighted sound levels and the percent of population annoyed. Figure 3-5 shows the level of acceptability for sonic booms based on the frequency and peak overpressure.

Table 3-3

Relationship Between C-Weighted and A-Weighted Sound Levels and Percent of the Population Annoyed

CDNL (C-weighted)	% Highly Annoyed	DNL (A-weighted)
48	2	50
52	4	55
57	8	60
61	14	65
65	23	70
69	35	75

Notes: CDNL - C-weighted equivalent of DNL
DNL - day-night average noise level (A-weighted)
Source: Committee on Hearing, Bioacoustics and Biomechanics, Assembly of Behavioral and Social Sciences 1981

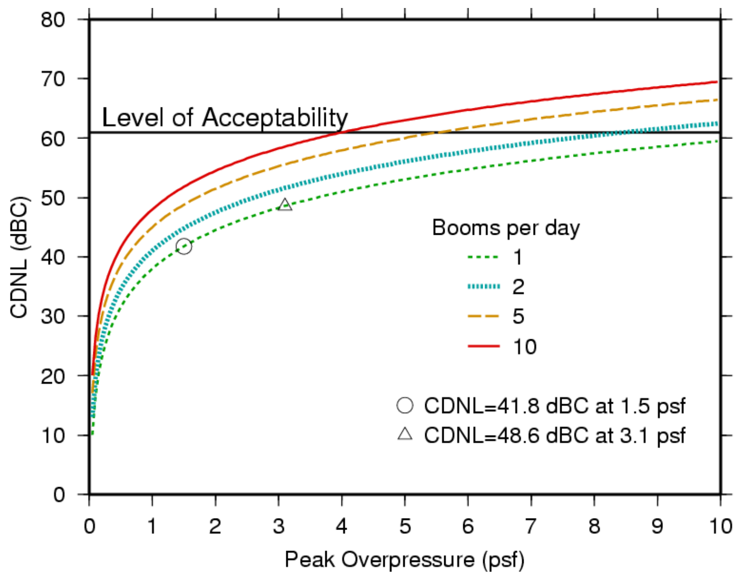


Figure 3-5

Relationship of CDNL to Peak Overpressure and Number of Daytime Sonic Booms

3.6 OCCUPATIONAL HEALTH AND SAFETY

Safety is defined as the protection of workers and the public from hazards. The total accident spectrum encompasses not only injury to personnel, but also damage or destruction of property or products. For worker safety, the boundary of the immediate work area defines the ROI. For public safety, a much larger area must be considered. This area varies depending upon the nature of the operation, but may extend for miles beyond the source of the hazard.

Potential health and safety issues within the R-2508 Complex, restricted area R-2515, Edwards AFB, Sea Range, and NTTR include radiological, biological, chemical, and physical hazards, as well as weapons, flight, ground, range, and test [systems] safety. Explosions, fires, and spills of propellants could also endanger workers; however the potential impact would generally be limited to the vicinity of the accident.

The DoD (including the Army, Air Force, and Navy) and NASA DFRC institutional safety programs are intended to minimize accidental injury, illness, and loss of property. The Safety Office at each range and base of operations is responsible for monitoring the safety programs through a system of inspections, surveys, audits, and follow-up investigations. Elements of the safety program include accident and injury prevention and reporting, fire prevention and protection, emergency preparedness, and hazardous material and waste management. Emergency Response Plans are in place to address emergencies such as earthquakes, aircraft accidents, fires and explosions, bomb threats, civil disturbances, nuclear

emergencies, and toxic vapor releases or chemical spills. Range procedures and base-wide safety reporting systems encourage employees to report their concerns about workplace safety.

Safety and Occupational Health in areas of the R-2508 Complex, Sea Range, and NTTR that are not on military installations is governed by California Occupational Safety and Health Administration and Public Safety Programs under the guidance of the California Division of Occupational Safety and Health or the Nevada Bureau of Health Protection Services.

The test and evaluation of UAVs addressed by this EA will primarily be supported, launched, and recovered from Edwards AFB; therefore flight safety at Edwards AFB is the focus of this section. As such the majority of potential safety concerns would be assessed and mitigated by the 95 ABW, NASA DFRC, and AFFTC. The AFFTC's occupational health program is intended to recognize, evaluate, and control workplace factors or stresses that may cause sickness, impaired health, or significant discomfort to employees. To protect AFFTC personnel from noise hazards, hearing protection is used if personnel are exposed to noise levels exceeding 85 dBA. The program identifies and quantifies worker exposure to hazardous chemicals, noise, and radiation. Through AFFTC's Hazardous Communication Program, employees are educated regarding proper chemical management principles and procedures.

3.6.1 Range Safety

The national range system, established by Public Law (P.L.) 81-60, was originally sited based on two primary concerns: location and public safety. Thus, range safety, in the context of national range activities, is rooted in P.L. 81-60 and Department of Defense Directive 3200.11, *Use Management*, and *Operation of Department of Defense Major Range and Test Facilities*; both provide the framework under which the national ranges operate and provide services to range users. To provide for the public safety, the ranges, using a Range Safety Program, ensure that the weapons delivery testing presents no greater risk to the general public than that imposed by overflight of conventional aircraft. Range safety requirements apply to UAVs just like any other aircraft.

It is the policy of the Edwards AFB Range and the NASA DFRC Western Aeronautical Test Range to ensure that the risk to the public, military personnel, government civilian workforce, contractors, and to national resources is minimized to the greatest degree possible. This policy is implemented by using risk management in the areas of public safety, launch area safety, and landing area safety. Range users are required by Edwards AFB to demonstrate, through risk modeling, that the lowest possible risk is achieved, consistent with AFFTC mission requirements and risk guidance. The AFFTC Chief of Safety

has responsibility for approving the proposed flight plans and flight safety criteria. The AFFTC Commander has final authority and responsibility for the safety of the proposed action. The Range Commander may deviate from these mission criteria based on geography, weather, and national need; however, the basic standard is no more risk than that voluntarily accepted by the general public in normal day-to-day activities (NASA 1997).

Health and safety issues related to aircraft operations (including UAVs) (both routine and emergency management) involving ground personnel working near operating aircraft during taxiing and inspection activities, aircrews using runways (lakebed and non-lakebed surfaces), and personnel present during emergency operations, aircraft malfunction, or other mishap are specifically addressed in AFFTCI 11-1, *Air Operations*, and AFFTCI 11-2, *Ground Operations*. These instructions address in-flight operations, flight preparation, and ground procedures directly related to the safety of personnel on the ground, as well as emergency procedures for the protection of all personnel at Edwards AFB. A fundamental requirement of the Edwards AFB Flight Safety Program is that each unit conducting or supporting flight operations has a flight safety program as well as a Midair Collision Avoidance Program.

3.6.2 Exposure Hazards

Non-ionizing Electromagnetic Radiation

Non-ionizing electromagnetic radiation (EMR) comes from two major sources: radio frequency emitters (i.e., radars, radar-jamming transmitters, and radio communication equipment), which are regulated by Air Force Occupational Safety and Health (AFOSH) Standard 48-9, *Radio Frequency Radiation (RFR) Safety Program*; and laser emitters, which are regulated by AFOSH Standard 48-139, *Laser Radiation Protection Program,* and DoD Instruction 6055.11, *Protection of DoD Personnel from Exposure to Radiofrequency Radiation and Military Exempt Lasers*. Sources of EMR exist throughout the flightline area and include fixed location radar, airfield management equipment, and aircraft equipment/instrumentation. Electromagnetic radiation can cause thermal and photochemical injuries to humans, particularly to the eyes and skin. Standards and practices are in place to shield and isolate workers from operational hazards of existing EMR sources.

Bioenvironmental Engineering periodically makes visits to and evaluates the operations of all known AFFTC industrial radiation users as a part of the Industrial Hygiene Surveillance Program. This office also verifies (annually) the list of radio frequency radiation emitters and low-powered laser systems used on Edwards AFB. Any proposed use of emitters is evaluated using a preliminary radiation and lasing

hazard analysis. Using a permissible exposure limit (PEL) and maximum probable exposure, a proper hazard analysis is accomplished. The PEL and maximum exposure limit are expressed in terms of safe distance limits from the emitting source. Compliance with these limits is required as a standard operating procedure (95 ABW and AFFTC 2005a).

Lasers and High Power Microwaves

Lasers produce narrow beams of light that may or may not be in the range of light visible to humans. There are many laser-based systems used in Edwards AFB operations, most of which are used on aircraft during flight operations as target-range finders and target designators. Laser weapons are used for test and training activities at approved locations on Edwards AFB under scheduled and controlled conditions (i.e., Integrated Facility for Avionics Testing, Benefield Anechoic Facility) and as described in the *Environmental Assessment for Testing and Evaluation of Directed Energy Systems Using Laser Technology at Edwards AFB* (U.S. Air Force 2006a).

The use of high power microwave systems at Edwards AFB and within restricted area R-2515 is described in the *Environmental Assessment for the Integration and Developmental Testing of High Power Microwave Systems at Edwards AFB* (U.S. Air Force 2006b). These systems are tested under controlled conditions following stringent guidelines established to ensure the safety to personnel at Edwards AFB and the surrounding area, as well as non-participating resources, is enforced.

Explosives and Propellants

Explosives and propellants are used and stored in a number of locations throughout Edwards AFB. An inhabited building separation distance (or clear zone) has been established around each of the existing explosives and/or propellant use/storage locations. The size of the clear zone varies based on the quantity and type of explosive used or propellant stored there. Clear zones ensure the safety of all personnel in the area from the potential overpressure hazard associated with use and storage of these materials.

This page intentionally left blank.

4.0 ENVIRONMENTAL CONSEQUENCES

This chapter addresses the impacts associated with UAV flight operations and discusses the potential environmental consequences or impacts associated with Alternatives A, B, C, and D. Changes to the natural and human environment that could result from implementing Alternatives A, B, and C were evaluated relative to the existing environmental conditions. Specific projects may have actions not covered in this EA. UAV operations not analyzed in this document would remain the responsibility of the proponent test program office and would be addressed when they are ripe for decision.

4.1 AIR QUALITY

The primary impacts to air quality from the Proposed Action would come from emissions from the various vehicles and support equipment. UAV operations would make a relatively small contribution to the overall air emission at Edwards AFB. These predicted UAV emissions are listed by pollutant in Table 4-1. In all cases the emission levels are well below *de minimis* levels established by regulation, ranging from 5 to 30 percent lower than the threshold levels.

Table 4-1 Projected UAV Emissions from 2006–2012

	Emissions (tons/year)				
Year	**NO_2**	**VOCs**	**PM_{10}**	**SO_2**	**CO**
2006	2.31	0.05	1.36	0.11	2.37
2007	4.05	0.96	2.03	0.13	4.17
2008	5.16	1.26	2.58	0.18	5.29
2009	6.18	1.46	3.16	0.23	6.27
2010	6.56	1.50	3.25	0.25	6.55
2011	8.12	1.71	3.95	0.36	7.44
2012	7.42	1.60	3.70	0.35	6.93
Regulatory Limits	25	25	70[a]/100[b]	N/A	N/A

Notes: a – Conformity *de minimis* level for PM_{10} in KCAPCD.
b – Conformity *de minimis* level for PM_{10} in MDAQMD/AVAQMD/SJVAPCD/GBUAPCD.
AVAQMD – Antelope Valley Air Quality Management District
CO – carbon monoxide
GBUAPCD – Great Basin Unified Air Pollution Control District
KCAPCD – Kern County Air Pollution Control District
MDAQMD - Mojave Desert Air Quality Management District
NO2 – nitrogen dioxide
N/A – not applicable
PM10 – particulate mater less than 10 microns in diameter
SJVAPCD – San Joaquin Valley Air Pollution Control District
VOC – volatile organic compounds

The projections in Table 4-1 indicates the ozone precursor emissions (NO_2 and volatile organic compounds [VOCs]) would range from approximately 2.5 tons per year in 2006 to approximately 10 tons per year in 2011 (approximately 9 tons per year in 2012). These emissions range from 1 to 50 percent of the *de minimis* thresholds of 25 tons per year for NO_2 and VOCs within the AVAQMD and 100 tons per year for a serious ozone non-attainment area for the MDAB portion of Kern County (40 CFR Part 93 Subpart 153[b][2]). The predicted air emissions that would occur in MDAB portion of Kern County, where standards are more stringent than in the AVAQMD, would still be below *de minimis* standards. In addition, the emissions of ozone precursors would less than 0.1 percent of the total Kern County (40 CFR Part 93 Subpart 153[i]) and less than 0.1 percent of the total AVAQMD inventory.

4.1.1 Data, Assumptions, and Models Used in the Analysis

Potential air quality impacts would be attributed to emissions from UAVs, chase aircraft, vehicles, and support equipment directly related to the Proposed Action. The routine, recurring transportation of personnel and the future activities conducted would be similar in scope to those currently being conducted at existing facilities. These actions would result in no emission increases or emissions that are clearly below the *de minimis* threshold levels and are exempt. No new construction is expected, and no other measurable impacts were identified.

Emissions from potential UAVs were assumed to be similar to the Predator, Global Hawk, J-UCAS (X-45/X-47), F-15 and F-16. These aircraft were used as surrogates for consideration in the air quality analysis calculations (Appendix A). The number of flights for each category of UAV was based on AFFTC projections listed in Table 2-1. The utilization of F-15 versus F-16 as a chase aircraft was based on the typical annual utilization of these aircraft at Edwards AFB. Although the number of F-15 sorties has declined from 2001 through 2005, the emissions are calculated using the F-15 as a worst case for other undefined chase aircraft that may be utilized. Typical UAV flight missions are anticipated to last from up to 3 hours to over 36 hours with approximately 5 percent of that time spent below 3,000 feet AGL. Emissions from UAV and aircraft landing and takeoff and touch-and-go operation flights were calculated using engine emission factors specific to each potential engine and engine-operating mode (Air Force Institute for Environmental, Safety and Occupational Health Risk Analysis [AFIERA] 2002).

The AGE/ground support equipment (GSE) emissions were calculated using emission factors obtained from *AP-42: Compilation of Emission Air Pollutant Factors* (AFIERA 2002; U.S. EPA 1991; U.S. EPA 2000). AGE emissions were calculated based on the number of missions per year, phase of each mission,

and the type of aircraft being supported. The GSE emission calculations were performed utilizing duration of activity or miles driven and vehicle engine emissions for the given size ground transport vehicles.

Up to 40 percent of the flights could transition to the Sea Range or NTTR. Assuming that 5 percent of those flight operations would occur below 3,000 feet AGL, then up to 2 percent (5 percent of 40 percent) of the total flight operations would contribute to the emissions that occur below 3,000 feet. For these flight operations the lowest *de minimis* threshold value for ozone precursors, 10 tons per year, would occur in Los Angeles County. Since 2 percent of flight operations would generate from 0.05 to 0.20 ton of ozone precursors (which is significantly less than the 10 tons per year threshold) it would be reasonable to conclude that there would be no significant impacts.

4.1.2 Alternatives Considered

The primary area that would be affected by the emissions shown in Table 4-1 is the immediate area around Edwards AFB, situated in the MDAB portion of Kern County. The western Valley portion of Kern County, situated in the SJVAPCD, would not be affected by the proposed project because the UAV and chase aircraft would be well above 3,000 feet AGL in these areas, and the area is separated by the mountain ranges to the north and west of the Base.

Alternative A (UAV Flight Operations within the R-2508 Complex) (Proposed Action) would release emissions in the R-2508 Complex, including restricted area R-2515 and on and over Edwards AFB; however, these emissions would be expected to be well below *de minimis* levels as shown in Table 4-1. Emissions for flight operations in the R-2508 Complex and transitioning to the Sea Range or NTTR would also be below *de minimis* levels. By comparison, Alternative B (UAV Flight Operations Limited to Restricted Area R-2515) operations occurring in restricted area R-2515 and on and over Edwards AFB would be in a smaller area and would have a slightly higher local intensity, but they would still be well below *de minimis* levels. Most of the flight activities would occur above 3,000 feet AGL**.**

Alternative C (UAV Flight Operations Limited to the Airspace above Edwards AFB) would only have emissions occurring on and over Edwards AFB. The only difference between conducting flight operations as proposed under Alternatives A and B would be that under Alternative C the UAVs and chase aircraft would be operating in a limited area except when transitioning to the Sea Range or NTTR. Based on the conformity applicability screening analysis presented in Section 4.1, air emissions created

during these flight operations would be below *de minimis* levels for criteria pollutants; therefore air impacts resulting from implementing Alternative C would also be less than significant.

Alternative D (No-Action Alternative) is the status quo. UAV test and evaluation flights would continue to be conducted as currently planned and approved on a program basis. This would include programs such as Global Hawk, Predator, UCAV, and other UAV operations similar to manned aircraft flight test operations. Mission aircraft would comply with approved flight profiles per applicable DoD, Air Force, and AFFTC instructions.

Based on the conformity applicability criteria, the proposed project would conform to the most recent U.S. EPA-approved State Implementation Plan, and no further detailed conformity applicability screening analysis is required.

4.1.3 Significance/Mitigation Measures

Because the projected emissions for all of the Alternatives considered would be well below *de minimis* levels, there would be no new or unique emissions or local issues, and no other measurable impacts were identified, no mitigation measures are proposed.

4.2 AIRSPACE MANAGEMENT AND AIR SAFETY

The primary impact on airspace management and air safety for the Proposed Action and Alternatives would result from additional flight operations in the R-2508 Complex and the FAA controlled NAS; however, the number of UAV and chase aircraft flight operations would only increase the current number of flight operations by an extremely small percentage. Potential air safety impacts, as with the operation of any aircraft, would be related to the ability of the UAVs and chase aircraft to see and avoid other aircraft as well as the pilots' and trained operators' ability to deal with contingencies without creating additional risks to people or property. Pilots, trained operators, and chase aircraft, or a combination of these, would provide a margin of safety so UAVs could see and avoid other aircraft and thus reduce the risk to people and property to acceptable standards. The criterion for UAV reliability and adequacy of safeguards (this criterion is summarized in Appendix B) is integral to the safety analysis completed by the Range Safety Office for each UAV flight test.

The projected number of flight operations—when compared to the level of flight activity in the R-2508 Complex—represents a less than 0.5 percent increase in flight operations in 2006 to 1.5 percent increase in 2011 (approximately 1.41 percent increase in 2012) (Table 4-2).

The percent increase shown in Table 4-2 is based on the average number of flight operations from 1997–2002 in the R-2508 Complex and R-2515 (AFFTC 2005) and number of flight operations at Edwards AFB in 2005 (Hagenauer 2006) compared to the projected number of flight operations shown in Table 2-2. The percentage of UAV and chase aircraft flight operations operating at Edwards AFB and in restricted area R-2515 would be higher than for the R-2508 Complex; however, the increase would still be less than 6 percent if added to the current level of operations. Because these new UAV programs would likely replace current programs, the actual increase would be expected to be even smaller.

Table 4-2

Percent Increase in Flight Operations in by UAV and Chase Aircraft in the R-2508 Complex, Restricted Area R-2515, and Edwards AFB for Flight Originating From Edwards AFB

Year	R-2508	R-2515	Edwards AFB
2006	0.43	1.10	1.69
2007	0.58	1.48	2.29
2008	1.10	2.80	4.32
2009	1.30	3.29	5.08
2010	1.38	3.51	5.41
2011	1.50	3.82	5.89
2012	1.41	3.58	5.53

In 2004 the Los Angeles Center Air Route Traffic Control Center which oversees the airspace over Edwards AFB and the R-2508 Complex, handled over 2.1 million aircraft. If 40 percent of the proposed UAV and chase aircraft flights identified in Table 2-2 and all of the UAV and chase aircraft flights identified in Table 2-3 were conducted in the FAA controlled NAS, the change when compared to FAA projections would result in a less than 0.03 percent increase in 2006 and up to a 0.08 percent increase in 2011 and 2012. The annual growth rate for all aviation categories (general aviation, commercial, and military) from 2005 to 2017 is expected to be 2.0 percent per year as shown in Table 31, Appendix B (FAA 2006). Therefore, the potential impacts on airspace management and air safety resulting from UAV flight operations would be less than significant.

4.2.1 Data, Assumptions, and Models Used in the Analysis

Airspace management and air safety of UAVs are central issues that must be evaluated to determine potential impacts on other aircraft flying in the NAS. Airspace would be affected or impacted if any of the following occurred:

- Movement of other air traffic (civilian or commercial) in the area was restricted;
- Conflict with air traffic control in the region (e.g., see and avoid or communications) occurred; or
- There was a change in operation or designation of airspace used for other purposes (e.g., conflict with operations within the MOAs, restricted areas, and other SUA).

Management of UAV operations is still evolving. The approach to future management will likely continue to be divided into operations under the FAA in the NAS and operations that remain within restricted airspace.

4.2.1.1 Operations in the NAS Under FAA

Up to the present, for UAV flights within the NAS (outside restricted areas or warning areas) the Air Force has operated under the COA process. An example of a COA is provided in Appendix B. With the application for the COA, the proponent must identify and define specifics of the flight operations including proposed route of flight, altitudes, duration, and frequency of flight. The COA process is a long-standing FAA method of approving one-time airspace events that by their nature fall outside most normal FAA directives (e.g., air shows, aerial demonstrations, special competitions, unusual record attempts) This process has been applied to flight of UAVs by writing the COA for an extended but clearly defined time period, area of operations, and method of control. The FAA, in coordination with the DoD, is currently reviewing alternate methods for authorization and management of UAVs within the NAS. Any future procedures will be promulgated through the FAA rule-making process, which provides for public review and comment to ensure a level of safety equivalent to that accepted for existing manned aircraft operations. Individual COAs have relied on established procedures and provisions to ensure safe operations and have included some of the following:

- Using a manned chase aircraft when in airspace that could include other aircraft operating under visual flight rules (VFR) (see-and-avoid, generally below 18,000 ft above MSL).

- Maintaining two-way radio communications between air traffic control (ATC) and the pilot in control via the UAV.
- Meeting the same requirements as commercial aircraft to operate effectively and safely within the airspace and operating under an instrument flight rules (IFR) clearance with ATC.
- Requiring altitude reporting by an altitude reporting transponder in the same manner as manned aircraft operating under IFR.
- Specifying altitude/route restrictions that prohibit other aircraft from entering an area used by the UAV.
- Employing high-altitude flight procedures (generally above 45,000 feet above MSL, but variable by location and potential for other air traffic) for UAV flights in the NAS without a chase.
- UAVs operated by a certified pilot or trained operator.

An example of a COA is provided in Appendix B.

4.2.1.2 Operations in Restricted Areas or Warning Areas

When a restricted or warning area is active under a particular controlling agency, only aircraft permitted by that agency may enter the airspace. When operating within a restricted or warning area, a UAV would be separated from any non-participating aircraft. The operating procedures are set by the controlling agency based on the other types of airborne operations in the area and will provide a level of safety equivalent to that for manned aircraft. Provisions have included the following:

- Exclusive use of the airspace by only the UAV;
- Direct radar monitoring of all aircraft and UAVs within the airspace with two-way radio communications between all participating pilots/UAV operators/controllers;
- A direct method of position monitoring that can include normal radar and altitude monitoring or alternatively an instrumentation system using ground or GPS-based techniques; and
- Chase aircraft.

4.2.2 Alternatives Considered

4.2.2.1 Alternatives A, B, and C (Flight Operations Within R-2508 Complex, Restricted Area R-2515, and Edwards AFB)

Impacts on the airspace resulting from flight operations by UAVs within the R-2508 Complex, restricted area R-2515, and in the airspace above Edwards AFB would be less than significant. Military flight operations are a normal occurrence in the R-2508 Complex. Procedures and requirements for operating UAVs in this airspace are outlined in Section 2.7 of the *R-2508 Complex Users Handbook* (Edwards AFB 2005) which can be found online at http://r2508.edwards.af.mil/Downloads/index.html.

While operating in restricted area R-2515 and over Edwards AFB, the UAVs and chase aircraft activities would fall inside the scope of normal activities within restricted airspace that may be designated as exclusive use airspace during the specific flight operation. Conflicts with other aircraft within restricted area R-2515 and Edwards AFB airspace would be less than significant because operations within this airspace are scheduled and closely controlled. Aircraft that are not scheduled for or authorized to use the airspace cannot enter restricted airspace. In August 2005 the X-45A UAV completed 64 flight operations in restricted area R-2515 without impacting other aircraft (Defense Advanced Research Project Agency 2005). Specific guidelines for UAV flight operations are addressed in AFFTC Instruction 11-1, *Flying Operations*. Flights by UAVs are required to abide by the specific guidelines for remotely operated aircraft as stated in Chapter 15 of the AFFTC instruction as well as abide by the overall flight requirement for manned aircraft. Flights operating outside of restricted area R-2515 would be required to comply with these requirements plus any FAA requirements. Ongoing coordination between the FAA and Air Force which occurs on a routine and recurring basis, would still be required. A *Summary of UAV Safety Regulations and Processes for Flight Operations at Edwards Air Force Base, California* has been included in Appendix B.

The UAV flights transiting from Edwards AFB (within the R-2508 Complex) to the Sea Range or NTTR would obtain flight clearances similar to any other aircraft leaving the R-2508 Complex airspace. Figure 4-1 shows the recommended entry and exit points for aircraft leaving the R-2508 Complex. UAV flights originating from Edwards AFB would use these typical entry and exit points unless specific mission requirements dictated otherwise or the FAA approved alternate entry and exit points determined on a case-by-case basis.

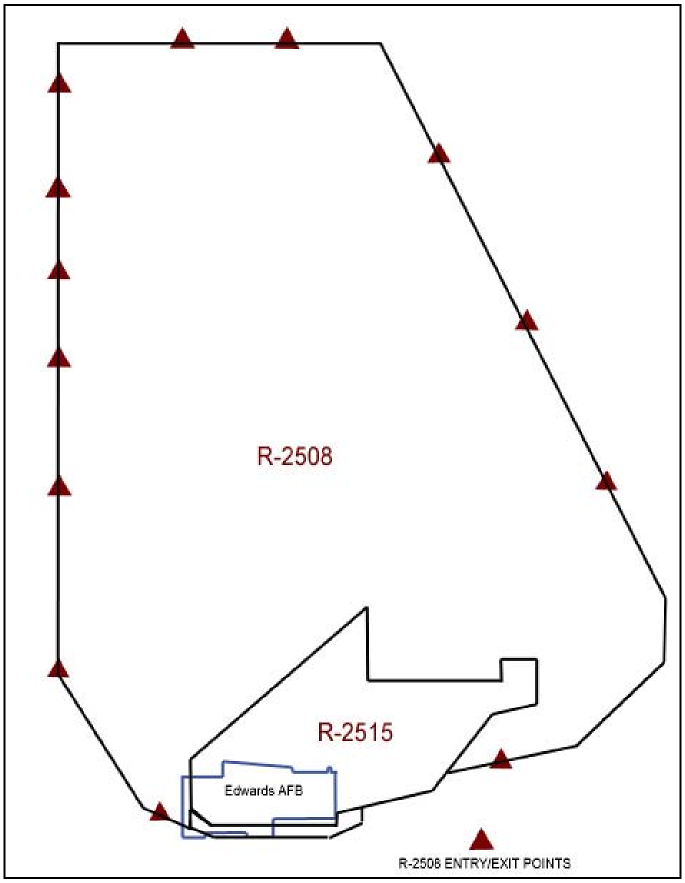


Figure 4-1

R-2508 Entry and Exit Points

For UAVs FAA Order 7610.4J, Special Military Operations, Chapter 2, Section 9, Remotely Operated Aircraft prescribes how the aircraft must be operated. For operations outside of restricted areas or warning areas, the Air Force or NASA must apply for a COA. A detailed description of the UAV capabilities and proposed method of providing an equivalent level of safety for see-and-avoid of the piloted aircraft would be required. As cited earlier, procedures may change as the FAA promulgates new rules. The UAVs would operate under IFR until they have entered the Sea Range or NTTR and then would operate according to procedures established for the range airspace. No impacts would be expected from these activities because they would be integrated and would operate according to FAA rules.

From 1997 to 2003 the Class A mishap rate for UAVs like the Predator was 41.27 per 100,000 flight hours (Air Force Safety Center 2003). Advanced Research Project Agency's Reliability Analysis measured the system failure level for the Global Hawk at a Class A mishap rate of 6.16 per 100,000 flight hours (U.S. Air Force 2001a). As a comparison, during the first 5 years of its operational life, the F-16

aircraft demonstrated a Class A mishap rate of 43.61 per 100,000 flight hours. As an aircraft matures and greater experience is gained in operating and maintaining it, fewer mishaps occur. The current Class A mishap rate for the F-16 aircraft is 4.19 per 100,000 flight hours (Air Force Safety Center 2003). Flight safety and the potential for an accident varies depending on the UAV, assigned mission, and maturity level; however, one could surmise that by following prescribed safety and mitigation procedures as described in Appendix B, the potential impact on airspace management and air safety would be mitigated to an acceptable risk level.

4.2.2.2 Alternative D (No-Action Alternative)

Alternative D (No-Action Alternative) is the status quo. UAV test and evaluation flights would continue to be conducted as currently planned and approved on an individual basis. This would include such programs such as the Global Hawk, Predator, UCAV, and other UAV operations similar to manned aircraft flight test operations. Mission aircraft would comply with approved flight profiles per applicable DoD, Air Force, and AFFTC instructions. There would be no additional impacts on airspace management or air safety resulting from the No-Action Alternative.

4.2.3 Significance/Mitigation Measures

Flight operations for UAVs operating in the R-2508 Complex, restricted area R-2515, and Edwards AFB and transitioning to the Sea Range or NTTR would be accomplished in accordance with strict guidelines promulgated by both the Air Force and FAA. By following these guidelines, which include training requirements for pilots and operators and safety analyses, the impacts on airspace management and air safety created by UAV and chase aircraft flight operations would be less than significant. The Air Force and NASA would continue to conduct operations in accordance with best management practices.

4.3 HAZARDOUS WASTE/HAZARDOUS MATERIALS

The weight of the hazardous waste generated by the UAVs when compared to the quantity of hazardous waste generated annually at Edwards AFB would be extremely small. The predicted weights are shown in Table 4-3 and would result in a less than 0.2 percent increase during any year; therefore the impacts on hazardous materials, hazardous waste, and solid waste resulting from UAV flight operations would be less than significant. Impacts on hazardous waste/hazardous materials and solid waste resulting from UAV flight operations come from the maintenance, servicing, and operation of the UAVs, aircraft, and support equipment.

Table 4-3

Annual Weight/Percent of Hazardous Waste Generated by UAVs at Edwards AFB

Year	UAV Flights	Hazardous Waste Generated (pounds)	Percent of Total Hazardous Waste
2006	80	293	0.05
2007	165	604	0.10
2008	215	787	0.13
2009	260	952	0.16
2010	285	1,043	0.17
2011	330	1,208	0.20
2012	330	1,208	0.20

Note: Weight of hazardous waste generated is based on an average of 3.66 pounds generated per sortie (flight operation) (Air Force Flight Test Center 2001).

4.3.1 Data and Assumptions Used in the Analysis

The types hazardous materials required for UAV flight operations would be the same as for other aircraft: jet propellant-8 (JP-8) and other petroleum, oils, and lubricants. Management of materials associated with UAV and aircraft launches, recoveries, and servicing are governed by Air Force instructions. When the UAV is on the runway or flightline at Edwards AFB, hazardous materials and hazardous waste are managed per the requirements of the AFFTC *Hazardous Waste Management Plan* and NASA *DFRC Centerwide Procedure, DCP-S-102 Environmental Management System, Chemical Management*. If a spill occurred, the hazardous waste would be cleaned up in accordance with the AFFTC SPR Plan 32-4002, *AFFTC Oil and Hazardous Substance Spill Prevention and Response Plan*.

Specific hazardous waste generation rates for the different classes of UAVs and chase aircraft were not available; however, data on hazardous material used by the Global Hawk by personnel at Edwards AFB indicated that very small quantities of hazardous materials and minimal quantities of hazardous waste are generated by each Global Hawk UAV mission (U.S. Air Force 2001a). Hazardous waste generated by the UAV maintenance activities includes small quantities of fuel- and/or solvent-laden rags/absorbent, and used oil and hydraulic fluid. While used oil is not an EPA-classified hazardous waste, it is considered a hazardous waste in California.

At stated in the *Global Hawk Main Operating Base Beddown Environmental Assessment* (Air Force 2001a) an estimated 128 pounds of hazardous waste is generated by a single Global Hawk UAV per year. Based on an estimated 35 sorties per UAV per year, 3.66 pounds of hazardous waste would be generated

per sortie (flight operation). Since UAVs similar to the Global Hawk class would generate similar quantities of hazardous waste, a conservative estimate of 293 to 1,208 pounds of hazardous waste would be generated each year by UAVs operating from Edwards AFB.

Up to 100 sorties per year were assessed to have no significant impact on hazardous waste or solid waste. While the Proposed Action and Alternatives would conduct from 80 to 330 UAV sorties annually, less than 100 sorties per year would involve the release of armed munitions at PB-13 at Edwards AFB. The potential impacts of the debris (solid waste) resulting from the weapons delivery at PB-13, the only site on Edwards AFB authorized for live munitions, were assessed in the *Environmental Assessment for Armed Munitions Integration Testing on the Precision Impact Range Area* (95 ABW and AFFTC 2005b).

4.3.2 Alternatives Considered

4.3.2.1 Alternatives A, B, and C (Flight Operations Within R-2508 Complex, Restricted Area R-2515, and Edwards AFB)

The accumulation of hazardous materials and hazardous waste would normally be associated with the maintenance, servicing, and operation of UAVs, chase aircraft, and support equipment (AGE) at Edwards AFB, not in the airspace or land areas associated with restricted area R-2515 and the R-2508 Complex.

Significant quantities of hazardous materials and hazardous/solid waste would not be anticipated to occur in these areas as a result of the Proposed Action or Alternatives. Since most flight operations would typically originate at Edwards AFB, the use of any hazardous materials and generation of any hazardous waste and solid waste would be the same regardless of which alternative were selected. As shown in Table 4-3, a less than 0.2 percent annual increase in hazardous waste would be generated by UAVs. Chase aircraft are existing assets at Edwards AFB. Hazardous waste generated by chase aircraft would already be accounted for since mission aircraft assigned to Edwards AFB and NASA routinely conduct flight operations in support of other programs. The waste generated by the chase aircraft during routine and recurring flight operations are well within the capability of the Base to manage under the guidance of the hazardous materials and hazardous waste management plans. Consequently, no additional impacts on hazardous waste would result from chase aircraft. As such, no significant impact on hazardous materials or hazardous waste would be anticipated as a result of implementing Alternatives A, B, or C.

4.3.2.2 Alternative D (No-Action Alternative)

Alternative D (No-Action Alternative) is the status quo. UAV test and evaluation flights would continue to be conducted as currently planned and approved on an individual basis. This would include programs such as Global Hawk, Predator, UCAV, and other UAV operations similar to manned aircraft flight test operations. Hazardous materials and hazardous waste generated by these programs have been assessed to create no significant impact (U.S. Air Force 2001a). Hazardous material use and hazardous waste generated as a result of these operations would be managed per applicable DoD, Air Force, and AFFTC instructions. There would be no unanticipated impacts on hazardous materials, hazardous waste, or solid waste resulting from the No-Action Alternative.

4.3.3 Significance/Mitigation Measures

The types of wastes generated during UAV flight operation support are similar to current waste streams for manned aircraft. Edwards AFB generates over 600,000 pounds of hazardous waste annually (U.S. Air Force 2001a) and is classified as a large quantity hazardous waste generator. An increase of 0.2 percent would not change the hazardous waste generator status of the base. The small quantities of wastes could easily be assimilated and managed by current management practices. Since the types of wastes would not be new, would not change the generator status, would be the same as other programs, and could be managed by current practices; it could reasonably be concluded that a 0.2 percent increase in waste created from UAV flight operations would be less than significant. Edwards AFB would continue to implement standardized hazardous waste/hazardous material/solid waste management procedures and best management practices associated with use and disposal of hazardous materials/hazardous waste and solid waste.

4.4 NATURAL RESOURCES

Potential impacts on natural resources would be attributed to effects from contact with UAVs, chase aircraft, program personnel, support equipment, or the testing of associated weapon systems. UAV flight related activities would use existing runways, previously disturbed areas, roadways, and targets already approved for similar types of operation. The U.S. EPA has identified the criterion used to analyze all aspects of the natural environment. The criterion focuses on ecological and evolutionary processes, such as natural disturbance regimes, hydrological processes, nutrient cycles, and biotic interactions. As a practical matter the guidance suggests that [environmental] assessments should focus on ecological processes and how they can be affected by various stressors (U.S. EPA 1999a). Examples of stressors

could include human presence, litter, sewage, physical disturbance (trampling and erosion), removal of things, the introduction of exotic species, and water use.

The routine and recurring operation of UAVs would be similar to current aircraft operations which are governed, regulated, and managed to prevent and/or minimize any impacts on these resources. Chase aircraft are part of the existing routine and recurring flight operations that conduct missions from Edwards AFB and operate throughout the R-2508 Complex. Support equipment would be operated from designated areas such as the aircraft hangars, aprons, dry lakebeds, existing roads, and previously disturbed areas on Edwards AFB. Program personnel would continue to follow the guidelines promulgated by the 95th ABW and the 412th Test Wing that ensure the impacts on natural resources remain less than significant.

The testing of specific weapon systems is not platform specific and would be governed by the environmental documentation for that system. An environmental review of the weapon system impacts would be completed prior to testing it with a UAV. Consequently, UAV flight test activities would not significantly increase impacts on plants, wildlife, or habitat in this ROI as addressed by this programmatic assessment.

4.4.1 Data, Facts, and Assumptions Used in the Analysis

Facts used in the analysis conclude that

- No new facilities would be constructed;
- There would be no ground disturbing activities other than at preexisting disturbed areas; and
- Existing facilities and disturbed areas would be used to the maximum extent possible.

The U.S. EPA identified 10 ecological processes that should be evaluated to determine potential adverse effects on habitat and ecological resources.

- Habitats Critical to Ecological Processes. Loss of keystone habitats, such as desert springs, California native grasslands, Southern California coastal sage scrub, and California riparian forests and wetlands are not planned. No construction is planned. UAVs would use existing runways and previously disturbed areas on the PIRA for launch and recovery activities.

- Patterns and Connectivity of Habitat Patches. Since no new construction, ground disturbing activities, or changes in land use are planned, there would be no expected loss of rare habitats, loss of connectivity among habitat patches, or change in homogeneity across the landscape.

- Natural Disturbance Regimes. No natural disturbance regimes such as fire, flood, or insect infestations, or ground disturbing activities would be expected to result from the Proposed Action or Alternatives. Increases to water sources, streams that would increase the vegetation in the desert climate, are not planned; as such additional fire sources or food sources for insects would not be expected.

- Structural Complexity. Loss or reduction of components that create structural diversity, such as coarse woody debris, Joshua trees, and downed trees; reduced structural complexity in riparian areas; and reduced complexity of micro-site structures would not be anticipated.

- Hydrologic Patterns. Changes in water chemistry, including temperature changes, reduced infiltration, increased surface flow, and wider swings in flow and increase flashiness, would not be expected. Construction activities that might alter the hydrologic patterns are not planned.

- Nutrient Cycling. Because direct or indirect contact with the habitat would be limited, a disruption of feedback loops that conserve and recycle nutrients or increase leaching of nutrients from the system, or alter levels and normal patterns of variation of nutrients would not be expected.

- Purification Services. The method by which the ecosystem breaks down waste and detoxifies contaminants and the ability of the system to process waste materials, toxics, or other contaminants would not be affected because wastes would be managed and disposed per specific federal and state guidelines.

- Biotic Interactions. Changes to the biota are not planned. Contact with sensitive species would be limited because sensitive species are not known to be present on the runways and other previously disturbed areas. Ground disturbing activities would be limited to previously disturbed areas.

- Population Dynamics. Mechanisms that tend to damp down fluctuations in populations, increase overpopulation irruptions, and cause population crashes would not be affected because of the extremely limited contact as noted above.

- Genetic Diversity. Loss of genotypes, a reduction in generic variation, and genetically based deformities and reproduction dysfunction would not be expected because activities would be limited to runways and previously disturbed areas, thus minimizing any potential for affecting genetic diversity.

The launch and recovery of UAVs would normally occur on established runways or dry lakebed runways that are used for that specific purpose, launching aircraft. Small, hand-launched UAVs would also be launched from existing disturbed areas or sites that would be evaluated and approved by 95 ABW/CEV; thus ensuring impacts on critical habitat would be mitigated by ongoing best management practices. The testing of any weapon system (whether it used kinetic energy [e.g., bombs, rockets, or missiles] or non-ionizing radiation [e.g., lasers or high power microwaves]) would be limited to existing targets specifically designated for the type of weapon system being tested. Typically, target sites are devoid of vegetation and habitat that wildlife would use for a food source or shelter. A finding of no significant impact has been issued for testing and integration of many of these various types of weapon systems at designated target sites on Edwards AFB. When applicable, additional NEPA analysis and mitigation measures as addressed for each type of weapons test would be implemented.

Ground targets would be located on Edwards AFB and airborne targets would only be fired upon so that debris resulting from the destruction of any target would remain on base and in previously disturbed areas. Ground disturbing activities by the UAVs would not be anticipated, except at designated target sites.

4.4.2 Alternatives Considered

The primary areas that would potentially be affected by UAV flight operations are the plants, wildlife, and habitat at Edwards AFB. Except for approximately 5 percent of the UAV flight operations, the aircraft would operate above 3,000 feet AGL, thus limiting the opportunity for potential impacts. Impacts would be the same as from manned aircraft.

4.4.2.1 Alternatives A, B, and C (Flight Operations Within R-2508 Complex, Restricted Area R-2515, and Edwards AFB)

Alternative A (UAV Flight Operations Within the R-2508 Complex) flight related activities would occur over the R-2508 Complex—including restricted area R-2515—and on and over Edwards AFB; however, potential impacts, if any, would only be expected to occur at Edwards AFB. Direct or visual impacts on any plant, animal, or habitat would not occur off-Base from planned flight test activities. As noted in Section 3.4, habitat for bighorn sheep is known to occur within this ROI, but not on Edwards AFB. The AFFTC requires that aircraft operate above 3,000 feet AGL in proximity to this known habitat and in noise sensitive areas. While this requirement is not directly associated with bighorn sheep or other natural resources, these natural resources would benefit from this requirement because the potential impact on natural resources would be limited.

Plants, Wildlife, and Habitat

The greatest potential for plants, wildlife, and habitat to be effected by UAV activities would occur if a UAV needed to be recovered from an undeveloped location. During recovery operations a combination of trucks, equipment, and personnel would need to travel to the landing site. To minimize impacts on natural resources, existing roads would be used as much as possible before driving off-road to access the UAV. However, recovery of UAVs from undisturbed areas is not planned; therefore preplanned mitigation would not be required. Any new target sites would be evaluated on a case-by-case basis to determine any potential impacts. Test plans would establish any environmental restrictions and mitigation requirements.

Threatened and Endangered Species

Since UAVs, chase aircraft, and support equipment would operate from previously disturbed areas that do not include the habitat that readily supports the threatened and endangered species noted to be at Edwards AFB, direct contact with these species would not be anticipated and therefore, no significant impact on the threatened and endangered species or habitat identified in Section 3.4 would be expected.

Noise and Visual Effects on Plants and Wildlife

Adverse effects of noise and visual impacts on plants would not be expected. Noise is not a known stress factor for plants or plant habitats.

Noise and visual impacts on wildlife could occur for the portions of the flight operations conducted below 1,000 feet AGL, the altitude accounting for the most reaction to visual stimuli by wildlife (Bowles *et al*. 1991, Lamps 1989). The USFWS considers aircraft flight below 2,000 feet AGL a potential concern for listed species or species of concern. In general, wild animals respond to low-altitude aircraft overflights. The startle response to noise of a passing shadow is the most readily observed and documented response of wildlife to aircraft overflight, but the adverse effect of this response is considered to be of a short term (minutes) and this short term response will not influence the demographic characteristics or spatial distribution of any wildlife species. Birds and mammals have been frequently observed to habituate to noise. Neither amphibians nor reptiles have been shown to have a well developed acoustic startle response (U.S. Forest Service 1992). A study on the impact of low-level aircraft flights and sonic booms on desert tortoises determined they experience a temporary threshold shift in hearing, but recover rapidly (Bowles *et. al* 1999). Furthermore, the study determined that overflight of the desert tortoise resulted in a "slight freeze" response with no long term ill effects or changes in metabolic rates. No adverse impacts on the Mohave ground squirrel would be expected because no ground disturbance is anticipated.

Because most UAV flight operations would occur above 3,000 feet AGL, and these flight operations would be similar to current routine and recurring manned aircraft flight operations, noise and visual impacts would not be expected to be significant.

Migratory Birds

Air strike hazards, the primary threat to migratory birds, would be the same for UAVs as for any other aircraft operating in the ROI. From 1985 to 1998, 168 incidents of bird strikes (12 per year) were reported for flight operations at Edwards AFB. Approximately 28 percent of those bird strikes occurred during low-altitude flight (Edwards AFB 2002). Since most UAV flights would be accompanied by a chase aircraft, the pilot in command would provide visual cues to the UAV controlling pilot to avoid an impact with a flock of birds that may be transiting the flight path. A comprehensive bird-aircraft strike hazard (BASH) program has been implemented at Edwards AFB to minimize habitat and vegetation that attract migratory and non-migratory species around the airfield. UAV flight operations would not be expected to significantly increase the impact on bird species at Edwards AFB; therefore, additional mitigation beyond the current BASH procedures would not be required.

4.4.3 Alternative D (No-Action Alternative)

Alternative D (No-Action Alternative) is the status quo. UAV test and evaluation flights would continue to be conducted as currently planned and approved on an individual basis. This would include such programs such as Global Hawk, Predator, UCAV, and other UAV operations similar to manned aircraft flight test operations. Potential impacts on natural resources from these flights have been addressed in other environmental documents, and it has been determined that these operations would continue within established Air Force guidelines. There would be no unanticipated impacts on natural resources resulting from the No-Action Alternative.

4.4.4 Significance/Mitigation Measures

For the Proposed Action and Alternatives, human presence and physical disturbance would be the most likely stressors; however, since human presence would be limited, no construction or ground disturbing activities are planned, and operations would be conducted from previously disturbed areas, the potential for an impact on natural resources would be expected to be less than significant. UAV flight operations would have minimal contact with natural resources including plants, wildlife, and habitat because operations would primarily be conducted from previously disturbed areas that do not typically support these resources. Consequently, it could be reasonably concluded that impacts would be less than significant under Alternative A, B, C, or D. UAV flight operations will abide by management practices that have been implemented by the AFFTC and Edwards AFB to minimize disturbances to natural resources.

4.5 NOISE

The primary impacts on noise for the Proposed Action and Alternatives would be from the UAVs, chase aircraft, and support equipment. The noise contribution from subsonic UAV flight operations at Edwards AFB resulting from a 6 percent increase in flight operations would increase the accepted day-night average noise level (DNL or L_{dn}) by less than 0.1 dB over current levels. Noise contributions by UAVs and chase aircraft traveling faster than the speed of sound would also add to the C-weighted impulse noise. The threshold level of acceptability for impulse noise impacts is based on the CDNL (L_{cdn}) of 61 dBC. Predicted CDNL levels at Edwards AFB and within restricted area R-2515 would be below L_{cdn} 57.5 dBC (AFFTC 1998b). Currently, no UAVs fly at supersonic speeds. If, in the future, supersonic UAVs are developed they would be expected to be a very small percentage of the total number of

proposed flight operations. If 20 percent of the UAV and chase aircraft flights exceeded the speed of sound, than an increase of less than 2 percent of supersonic flight activity would be predicted.

4.5.1 Data and Assumptions Used in the Analysis

The HUD considers exterior sound levels with a DNL of 65 dBA as acceptable and allowable. The measure CNEL itself is essentially the same as DNL except for the method of treating nighttime noises. In CNEL, the 24-hour period is broken into three periods: day (7:00 a.m. to 7:00 p.m.), evening (7:00 p.m. to 10:00 p.m.), and night (10:00 p.m. to 7:00 a.m.). Weightings of 5 dBA and 10 dBA are applied to the evening period and night period, respectively. For most time distributions of aircraft noise around airports, the numerical difference between a two-period and three-period day is not significant, accounting for several tenths of a decibel at most (U.S. EPA 1974).

The Federal Interagency Committee on Noise policy recommends that if screening analysis shows noise levels at noise-sensitive areas (e.g., schools, churches, hospitals) will be at or above a DNL 65 dBA and will have an increase of DNL 1.5 dBA or more, further analysis should be conducted for noise-sensitive areas between DNL 60 and 65 dBA where there is an increase of DNL 3 dBA or more due to the proposed noise exposure. Since the increase in subsonic sound levels would be 3 to 7 percent of the level that would trigger a requirement for further analysis, the extremely small increase resulting from UAV flight operations would not be expected to create any significant impacts on subsonic noise.

Impulse noise from sonic booms is measured differently than subsonic noise. A C-weighted DNL (CDNL or L_{cdn}) value of 61 dBC for impulse noise is equivalent to a DNL value of 65 dBA as shown on Table 3-4. Aircraft traveling faster than the speed of sound produce sonic booms with noise levels that are predicted to be predominantly less than L_{cdn} 55 dBC within the R-2515, with the highest predicted noise levels of L_{cdn} 57.5 dBC over north–central R-2515 where the Black Mountain Supersonic Corridor and High Speed Supersonic Corridor overlap (AFFTC 1998b). Figure 3-5 shows that up to 5 sonic booms per day would be below the acceptable threshold if the intensity of the sonic boom on the ground was below approximately 5.50 psf. The normal overpressure for sonic booms at Edwards AFB is nominally around 1.3 psf (AFFTC 2001). Currently, no UAVs fly at supersonic speeds. If, in the future, supersonic UAVs are developed, they would be expected to be a very small percentage of the total number of proposed flight operations. The AFFTC expects that less than 12 supersonic UAV flight operations would occur each year; consequently, it could reasonably be assumed the noise from the sonic booms from UAV flight operations would be below the threshold for the level of acceptability.

4.5.2 Alternatives Considered

4.5.2.1 Alternatives A, B, and C (Flight Operations within R-2508 Complex, Restricted Area R-2515, and Edwards AFB)

R-2508 Complex

Based on the number of flight operations that occur annually within the R-2508 Complex, the addition of up to 528 UAV and chase aircraft flights would represent a 1.5 percent increase in flight operations. A 2-percent increase in flight operations for other similar types of aircraft would result in less than 0.1-dB increase in DNL (AFCEE 2001). Therefore, based on Federal Interagency Committee on Noise policy, the increase in subsonic noise resulting from UAV flight operations would not require further evaluation and it could reasonably be concluded that no significant impacts on noise would result from the additional flight activity.

Restricted Area R-2515

In the *Environmental Assessment for Continued Use of Restricted Area R-2515* (AFFTC 1998b), adding the F-22 flight test program with over 6,500 F-22, F-16, and support aircraft flight operations showed a potential noise level increase of 6 percent, which would result in no significant impacts. Since the number of flight operations for this proposed action would be 2.5 percent of the F-22 flight test program, the potential noise impact for a less than 4 percent increase in UAV flight operations in restricted area R-2515 would also be expected to be less than significant.

Edwards AFB

In addition, since the increase in noise would be less than the 2-dB DNL increase threshold noise that requires updating an Air Installation Compatible Use Zone study, an update would not be required.

The potential impact of up to 528 additional UAV and chase aircraft flights annually would represent less than a 6 percent increase in flight operations at Edwards AFB (AFFTC 2005). The sound exposure level (SEL) of the small Predator class UAV, when compared with the SEL of an F-15A aircraft, is very small. Predator class SEL values are 23 to 32 dB lower than those of the F-15A, depending on the distance. The SEL values converge as distance increases, because there is higher atmospheric absorption for the F-15A emissions, which have higher frequency content (U.S. Air Force 2003b). The noise from the large-class

UAV would be similar to the noise from a Global Hawk UAV, which ranges from 92 dB at 500 feet AGL to 81 dB at 2,000 feet AGL. The noise levels for the chase aircraft like the F-16 would range from 116 dB at 500 feet AGL to 104 dB at 2,000 feet AGL. Due to the logarithmic nature of dB, an aircraft generating noise levels 10 dB or more below another aircraft in the same area would not be discernable to the human ear, nor contribute to the cumulative noise levels (DNL) (U.S. Air Force 2001a). The noise from chase aircraft would be similar to the noise created by current F-15 and F-16 flights. The total number of chase aircraft flights would be less than 4 percent of the current level of activity for F-15 and F-16 aircraft. Therefore, the noise created by the UAVs flying with chase aircraft would be masked by the noise from the chase aircraft. When compared to the types of aircraft and significance level described for the *Environmental Assessment for Continued Use of Restricted Area R-2515* (AFFTC 1998b) for a 6 percent increase in activity, which is considered less than significant, one could reasonably conclude that the same types of flight activities would also result in a less than significant noise impact. Because the noise impacts from these additional UAV flights would be less than significant, no mitigation measures would be required.

Noise Impacts on from Flight Operations Exceeding the Speed of Sound and Subsonic Operations

The impact on noise from UAV flight operations traveling faster than the speed of sound would be expected to be below the threshold level of acceptability; thus, no specific mitigation would be required. The current 65-dBA CNEL contour as shown in Figure 3-4 is contained entirely within the base boundary at Edwards AFB. Therefore, a less than 0.1-dBA increase in DNL would not be expected to significantly increase the CNEL contours, which would remain within the base boundaries, and no mitigation would be required

Noise Impacts on Wildlife

A wide range of impacts on wildlife due to aircraft overflights has been reported in literature. Behavioral responses are highly variable depending on the method of study, species in question, special and temporal parameters, and other characteristics (95 ABW and AFFTC 2005b).

After years of study on the effects of noise on natural resources, the information and data collected do not support the contention that noise generated by aircraft harms biological resources (95 ABW and AFFTC 2005b). However, the effects of military flight operations on wildlife can be summarized:

- There is no evidence to support the conclusion that noise and sonic booms associated with military overflight activities have a negative effect on populations of wild animals;
- Habituation to aircraft noise occurs with most species.

4.5.2.2 Significance/Mitigation Measures for Noise Impact in the R-2508 Complex

Aircraft will maintain a minimum altitude of 3,000 feet AGL vertically and 3,000 feet laterally when flying near the noise sensitive areas in the R-2508 Complex as described in the *R-2508 Environmental Baseline Study* (95 ABW and AFFTC 2005a). This would include flight operations in the Isabella, Owens, Panamint, and Saline work areas that overlie several land management areas including:

- Sequoia-Kings Canyon National Park;
- John Muir Wilderness;
- Domeland Wilderness (1977 boundaries); and
- Death Valley National Park (boundaries as designated for Death Valley National Monument in 1994).

Low level operations over the Sequoia National Forest are also limited from May 23 to September 30 after 8:00 p.m. on all Friday, Saturday, and Sunday nights, and during the Memorial Day, Independence Day, and Labor Day weekends. This excludes mission essential flights that have been coordinated with the Central Coordinating Facility at least 3 working day prior to the low-level flight.

4.5.3 Alternative D (No-Action Alternative)

Alternative D (No-Action Alternative) is the status quo. UAV test and evaluation flights would continue to be conducted as currently planned and approved on an individual basis. This would include programs such as Global Hawk, Predator, UCAV, and other UAV operations similar to manned aircraft flight test operations. Potential impacts on noise from these flights have been addressed in other environmental documents, and it has been determined that these operations would continue within established Air Force guidelines. There would be no unanticipated impacts on noise resulting from the No-Action Alternative.

4.6 SAFETY AND OCCUPATIONAL HEALTH

The primary impacts on safety and occupational health from the Proposed Action and Alternatives would be from weapons, flight, ground, range, and test [systems] safety hazards as well as radiological,

biological, chemical, and physical hazards, normally associated with aircraft flight operations at Edwards AFB. Extensive training of personnel, specific operating procedures, safety and hazard zones that restrict access to dangerous areas or operations, and continuous monitoring by base and range safety personnel would ensure UAV flight operations are conducted in a manner that reduces the opportunity for an impact on safety and occupational health. Therefore, UAV flight operations would not be expected to create any significant impacts on safety and occupational health.

4.6.1 Data and Assumptions Used in the Analysis

Maintenance and flightline personnel at Edwards AFB routinely service UAVs (e.g., Global Hawk), test aircraft, and chase aircraft (similar to the F-15 and F-16). Personnel associated with these UAV flight operations would be trained to identify new hazards and would be trained on procedures to minimize personal risk to those hazards.

Because the noise levels created by UAV and chase aircraft ground operations would exceed 85 dBA, maintenance and flightline personnel would be instructed on the use of ear protection as required by the Occupational Safety and Health Administration (OSHA 1981) and the hearing protection/conservation program. Such safety programs are currently institutionalized for all ground operations at Edwards AFB; therefore, no new safety measures would be required.

The primary difference between UAV and manned aircraft flight operations is the location of the pilot in command. For UAVs, the pilot in command would be in an operations control van, control center, in the field, or other aircraft.

The handling and storage of the munitions is conducted in accordance with the explosive safety procedures contained in Air Force Manual 91-201, *Explosive Safety Standards*. Munitions are stored and handled on the flight line in specified areas subject to strict management. Currently, PB-13 is the only target site on Edwards AFB cleared for the use of up to 500 pounds of net explosive weight–armed munitions. The minimum clear zone for 500-pound armed munitions in a UAV (aircraft) parking area is approximately 240 feet (DoD Directive 6055.9).

A crash of a UAV or an off-target impact of a laser beam, high power microwave beam, or ordnance could result in unavoidable adverse impacts on natural resources. However, because test procedures and safety criteria will be strictly adhered to there is a low probability of a crash. The whole purpose of this program is to aid in the integration weapon systems with improved accuracy that work on a variety of

UAV platforms. Accuracy of the Air Force weapons over the years has improved dramatically. For example in 1944 the Eighth Air Force achieved an accuracy of only 7 percent with bombs hitting within 1,000 feet of their aim point. The circular error of probability for World War II was 3,300 feet, 1,000 feet in Korea, and 400 feet in Vietnam. By the Gulf War the "smart airplane" dropping dumb bombs from low altitude could place an unguided munition within 30 feet of a target. Hellfire missiles fired by an Apache helicopter reported 102 direct hits out of 107 missiles expended (a hit rate of better than 95 percent). By following the strict test procedures, flight operations and testing of UAVs would not result in any significant unavoidable adverse impacts on natural resources.

4.6.2 Alternatives Considered

4.6.2.1 Alternatives A, B, and C (Flight Operations Within R-2508 Complex, Restricted Area R-2515, and Edwards AFB)

As noted in previous sections of this EA, the addition of up to 528 flights would result in a less than 1.5 percent increase in flight activity within the R-2508 Complex up to a 6 percent increase in flight activities at Edwards AFB if all the proposed flight operations were added to the current number of flight operations. Because the DoD and NASA have implemented specific safety and occupational health guidelines and procedures and conduct required safety training for all maintenance and flight line personnel involved with these programs, the likelihood that a significant impact on safety or occupational health resulting from UAV flight operations is highly unlikely to occur.

Hearing protection would still be required for any personnel on the flightline or in other areas where the noise level is above 85 dBA.

Pilots and UAV operators are trained and tested on safety procedures and undergo routine flight proficiency tests, thus minimizing the potential flight risks associated with operating these types of aircraft.

Safety interlocks, administrative controls, and hazard safety zones are incorporated with all weapons delivery activities, thus minimizing the potential for inadvertent release of any explosive devices. Munitions are stored in safe areas and managed in accordance with strict handling and safety procedures.

4.6.3 Alternative D (No-Action Alternative)

Alternative D (No-Action Alternative) is the status quo. UAV test and evaluation flights would continue to be conducted as currently planned and approved on an individual basis. This would include programs such as Global Hawk, Predator, UCAV, and other UAV operations similar to manned aircraft flight test operations. Potential impacts on safety from these flights have been addressed in other environmental documents; and it has been determined these operations would continue within established Air Force and NASA guidelines. There would be no unanticipated impacts on safety resulting from the No-Action Alternative.

4.6.4 Significance/Mitigation Measures

Since there would be no significant effects or impacts on safety or occupational health resulting from UAV flight operations, no mitigation measures would be required.

4.7 CUMULATIVE IMPACTS

4.7.1 Introduction

The CEQ Regulations define "cumulative impact" as the impact on the environment from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

The U.S. EPA suggests that in reviewing cumulative impacts the reviewers should focus on specific resources and ecological components that can be affected by the incremental effects of the proposed actions and other actions in the same geographic area. This can be determined by considering:

- Whether the resource is especially vulnerable to incremental effects;
- Whether the proposed action is one of several similar actions in the same geographic area;
- Whether other activities in the area have similar effects on the resource;
- Whether these effects have been historically significant for this resource; and

- Whether other analysis in the area have identified cumulative effects.

Additionally, the reviewers should determine whether the NEPA analysis has used geographic and time boundaries large enough to include all potentially significant effects on the resources of concern. Geographic boundaries should be delineated and include natural ecological boundaries and the time period of the project's effects.

The adequacy of the cumulative impact analysis depends upon how well the analysis considers impacts that are due to past, present, and reasonably foreseeable actions. This can be best evaluated by considering whether the environment has been degraded (to what extent); whether ongoing activities in the area are causing impacts; and the trend for activities and impacts in the area (U.S. EPA 1999b).

The ROI for cumulative impacts analysis includes Edwards AFB, restricted area R-2515, the R-2508 Complex, Sea Range, and NTTR. Specific projects that have occurred, those currently taking place, and those projected for the future will be identified in Section 4.7.2.

4.7.2 Past, Present, and Reasonably Foreseeable Actions

Over 90 to 95 percent of the past, present, and reasonably foreseeable actions occurring in the ROI are associated with ongoing operations at Edwards AFB. Other major actions and projects considered and addressed below would represent only a very small percentage of the total number of actions.

4.7.2.1 Flight Operations at Edwards AFB

Since 2000, the level of flight activity at AFFTC and Edwards AFB has remained fairly constant. Typically, when a flight test program is completed a new flight test program begins. The number of personnel, vehicles, aircraft, and basic infrastructure needed to support these flight activities is proportional to the number of sorties flown. The number of sorties associated with operations at Edwards AFB (including NASA-related flights) from 2000 through 2005 have been approximately 10,250 per year (AFFTC 2006). The number of sorties has varied from a 7.5 percent reduction from 2000 to 2001, a 2.7 percent increase from 2002 to 2003, and 9.0 percent decrease from 2003 to 2004 and 2004 to 2005. Detailed information showing the breakdown by aircraft type and sorties for those years can be reviewed in Appendix B.1, Table B-1. These aircraft regularly use the runways at Edwards AFB, restricted area R-2515, R-2508 Complex, low-levels routes, supersonic corridors, and targets on the PIRA to test aircraft integration and system capabilities. Overall, flight test operations at Edwards AFB have been analyzed in the *EA for the Continued Use of Restricted Area R-2515* (AFFTC 1998b). The proposed action in the *EA*

for the Continued Use of Restricted Area R-2515 concluded that these operations would result in no significant cumulative impacts.

Considering up to 528 additional flight operations as an increment to existing operations is probably the worst case assumption; the evaluations completed for the overall flight test activity at Edwards AFB cited were done with consideration for the normal and continuous initiation and completion of flight test programs. The UAV flight operations as addressed in this EA in all probability would not be additive to actions already analyzed, but rather would replace flight test programs recently completed. However, given the extensive flight operations at Edwards AFB, the addition of up to 528 flight operations per year would be an increase of approximately 6 percent over the 2005 totals but would still be 9 percent lower than the annual average. In general, since the operations (airspeeds, altitudes, aircraft type) of these test flights would be similar to those already evaluated, it would be expected these flights would have no measurable cumulative impact on most of the existing environment.

4.7.2.2 Edwards Air Force Base Runway Replacement Project

In November 2005, Edwards AFB began the runway replacement project, which will take place in three phases. During Phase I, beginning in 2006, a temporary runway is scheduled to be built adjacent to the current main runway. During Phase II, beginning in 2007, the demolition and construction of the replacement main runway will begin. During Phase III, the final construction of the remainder of the runway will be completed. The project is expected to be completed by the end of 2008.

4.7.2.3 Testing and Evaluation of Directed Energy Systems Using Laser Technology

In May 2006, the 95 ABW and AFFTC proposed to conduct flight and ground testing of laser systems at Edwards AFB beginning in 2006 through 2010 against targets on and above Edwards AFB. The number and intensity of flight tests would increase from approximately 140 flight tests and 24 ground tests in 2006 up to 394 flight tests and 24 ground tests in 2010. Up to 100 total areas could be disturbed on the Base with target sites limited to 5 acres each. This disturbance is within the guidelines established by the USFWS.

4.7.2.4 Integration and Developmental Testing of High Power Microwave Systems

In June 2006, the 95 ABW and AFFTC proposed to conduct integration and developmental flight and ground testing of high power microwave systems at Edwards AFB against targets on and above Edwards AFB. Up to 128 flight tests, 48 ground tests, and 600 hours of ground tests supporting non-aircraft

related ground tests would be conducted annually from 2006 to 2012. Up to 100 total areas could be disturbed on the Base with target sites limited to 5 acres each. Most of the target areas would be the same as used for the laser tests identified in Section 4.7.2.3. This land disturbance is within the guidelines established by the USFWS.

4.7.2.5 West Mojave Plan

The West Mojave Plan Area includes approximately 9.4 million acres that encompass most of California's West Mojave Desert. About one-third of the planning area is private land, another third is military bases, and the final third consists of public lands managed by the Bureau of Land Management (BLM). One of the main objectives is a strategy to conserve and protect the desert tortoise, the Mohave ground squirrel, and nearly 100 other sensitive plants and animals and the natural communities of which they are a part, and provide a streamlined program for complying with the requirements of the California and federal Endangered Species Acts.

4.7.2.6 Installation of New Urban Operations Complex Targets and UAV Target for the Nevada Test and Training Range

The U.S. Air Force proposes to construct an Urban Operations Complex Target and UAV target at the NTTR. These targets would simulate a weapons of mass destruction site, and the UAV targets would simulate a terrorist encampment in a canyon. Ordnance and munitions dropped on these targets would be consistent with those currently in use on the unmanned ranges of the NTTR. Target construction and maintenance would be consistent with current policy and procedures (U.S. Air Force 2006b).

4.7.2.7 Livestock Grazing Authorization

The BLM has proposed to issue a 10-year term grazing leases on three allotments in rural San Bernardino County to authorize ephemeral sheep grazing on public land within the jurisdiction of the Barstow Field Office. The vegetation communities are a mix of Creosote Brush Scrub, Mojave Mixed Scrub, and Saltbush Scrub (BLM 2006a).

4.7.2.8 Naval Air Weapons Station China Lake

Navy test and training operations and flight activities occur in the Superior Valley and the Randsburg Wash Electronic Combat Range on a routine basis. Because this range is within the R-2508 Complex, there may be potential effects between Navy, Air Force, Army, and NASA flight activities. The Navy has

operational concerns related to flight safety (jets and helicopters in the same area at the same time, radio frequency interference, and safety for troops training on the ground at Ft. Irwin).

4.7.2.9 California Wild Heritage Wilderness Act of 2003

The California Wild Heritage Wilderness Act of 2003 is a proposed Act to designate certain public lands as wilderness and certain rivers as wild and scenic rivers. The areas of concern for the analysis of this section include the wilderness study areas in the Mojave Desert that are proposed to become wilderness.

4.7.2.10 Naval Air Station Lemoore Military Operations Area

The U.S. Navy and California Air National Guard have initiated the establishment of a new SUA consisting of a new MOA and Air Traffic Controlled Assigned Airspace. The airspace would create an east-west corridor (Visalia/Hanford to points west) with some north-south viability (Fresno to Paso Robles/San Luis Obispo) and would be 30 nautical miles by 70 nautical miles and divided into five sectors. Base altitudes for the different sectors would range from 5,000 feet above MSL to 13,000 feet above MSL and up to 35,000 feet above MSL.

4.7.3 Overview

While each of these projects and programs presents opportunities for cumulative impacts, the combined effects of these cumulative impacts are not expected to be significant. The following sections will consider each of these is regards to the resource areas presented.

4.7.3.1 Airspace Management and Air Safety

Regarding U.S. EPA's considerations, airspace management and air safety are vulnerable to incremental effects. If the cumulative actions were to overload the capacity for the airspace or the controller's ability to manage flight activity, then cumulative impacts would be considered significant. With regard to other projects and flight operations occurring in the R-2508 Complex, the number of flight activities in SUA is strictly controlled, thus minimizing potential significance. There are similar actions occurring in the R-2508 Complex (including NAWC China Lake, the Sea Range, and the NTTR; however, each range manages and controls the number of activities within its boundaries, thus limiting potential cumulative effects. Historically, the number and type of flight operations in the R-2508 have not created airspace management and air safety issues because the flight planning and safety process has included risk analysis and the implementation of safety measures for each activity. Only flight activities that have meet the flight safety criteria have been allowed to launch from Edwards AFB and operate in the R-2508 Complex.

Because all flight activities in the R-2508 are scheduled and limited by the scheduling agency, the potential for cumulative impact has not been seen as a result of other proposed actions.

The Edwards AFB runway replacement project, installation of new urban operations complex targets, flight operations in the Superior Valley and Randsburg Wash range, and flight operations in a new Naval Air Station Lemoore MOA all have the potential for cumulative impacts with routine and recurring UAV flight operations. Flight activities in the Superior Valley, Randsburg Wash range, at NAS Lemoore MOA, and at targets on the NTTR would be expected to segregate flight activities, thus minimizing potential conflicts and cumulative effects.

Cumulative air safety impacts for aircraft and UAVs are primarily affected by the number aircraft and UAVs being controlled, the airspace they are operating in, their reliability, and the capabilities of the pilot or trained operators. The cumulative number of aircraft and UAVs is well within the capacity of the controllers to manage and monitor. Scheduling is coordinated with local FAA representatives to ensure the number of flights launching from the facility is within their capability to handle safely. If there is a potential overload, the FAA can delay a launch until an opening into the NAS is available or put an aircraft in a holding pattern until a route is safe for the aircraft or UAV to continue. Most aircraft and UAVs flight operations would be conducted in the SUA of the R-2508 Complex; an operating area specifically designated for this type of activity where it can be segregated from other air traffic. The UAVs would be evaluated and their reliability and specific safety requirements identified during the safety review process as addressed in the *Summary of UAV Safety Regulations and Processes for Flight Operations at Edwards Air Force Base, California* (Appendix B). These processes provide for a margin of safety to ensure that risk to the public at minimized. Aircraft pilots and UAV operators are highly trained for their specific type of aircraft or UAV in strict compliance with FAA and/or DoD training standards. Consequently, cumulative air safety impacts would be minimized by the processes in place, thus ensuring that no significant impacts would result from normal UAV flight operations.

4.7.3.2 Air Quality

The potential cumulative air quality impacts would result from operations occurring below 3,000 feet AGL. Emissions created by flight activity as addressed in Section 4.1 would be well below *de minimis* threshold levels. In recent years, air permits have accounted for air emissions for over 10,500 sorties without creating any significant air quality impacts. The cumulative totals based on the historical trends would result in a similar number of sorties; therefore, the cumulative effects would be expected to be less

than significant. The runway replacement project has the greatest potential for cumulative air quality impacts on Edwards AFB. Impacts would result from ground disturbances creating PM_{10} as well as CO and Sulfur oxides from the equipment and trucks. Air quality in the area is vulnerable to incremental cumulative effects. If emissions from other projects occurring in the same geographic region were to exceed the threshold *de minimis* values then the effects on air quality would be significant. Consequently, air quality permits would be reviewed to ensure emission levels would remain below standards. These potential cumulative impacts will be discussed in separate environmental analyses being developed to support the runway replacement project. Cumulative air emissions considered from other similar actions in the R-2508 Complex would include activities at NAWS China Lake and Ft. Irwin. Because activities for these other areas are in different air districts, have their own attainment status, and emissions below 3,000 feet AGL are geographically separated by mountain ranges that minimize the mixing of emissions from these areas, the cumulative effects for air quality would not impact the Edwards AFB area. Other projects noted in Section 4.7.2 that are in other air districts include the Naval Air Station Lemoore MOA and installation of targets at NTTR; air emissions from these areas would not contribute to cumulative effects for the same reasons as stated above.

Air quality impacts from proposed projects at Edwards AFB would not individually result in any significant long-term impacts, although they may result in localized impacts of short duration. Since most projects at Edwards AFB are primarily aircraft related, the air quality impacts of any significance would occur as a result of aircraft launch and recovery operations while the aircraft are operating below 3,000 feet AGL or as a result of testing a weapon system at one of the approved target sites within the R-2508 Complex (Edwards AFB, NAWS China Lake Range, or Ft. Irwin). Other air quality impacts would result from permitted OB/OD events that occur on the ranges. Due to the nature of the detonation process the chemicals in these emissions are consumed as part of the process. The air emissions from vehicles and support equipment would be expected to be similar to the current levels which are within Title V permit standards. Air emissions from the UAV flight operations program, when combined with the air emissions from the other programs, would still be below the *de minimis* thresholds for criteria pollutants within the air basins analyzed under this Proposed Action and Alternatives.

4.7.3.3 Natural Resources

The routine and recurring UAV flight operations would not create a significant cumulative impact on natural resources. As noted in Section 4.4, the greatest potential for impacts on natural resources occurs when vehicles are transiting roads to recover a UAV that could land in a previously undisturbed area.

The runway replacement project could result in cumulative impacts if the vehicles and equipment were to transit previously undisturbed areas. However, monitoring the vehicles and training the operators would minimize the potential for additional impacts. Approved UAV flights to the new targets authorized at the NTTR would be consistent with expected operations. The limited number of operations under this Proposed Action would not exceed the Proposed Action limitations for use of new targets at the NTTR; therefore, there would be no additional cumulative impacts. The flight operations of UAV would not result in any changes to grazing patterns as authorized by the BLM; therefore cumulative impacts from the Livestock Grazing Authorization would not be expected to result in any additional cumulative impacts on natural resources. The cumulative effects of the windblown soils and contaminants on plants in the target areas would be considered less than significant. The immediate target areas on the Edwards AFB, NAWS China Lake, and Ft. Irwin ranges are generally devoid of plants, and the areas outside the immediate target areas are sparsely populated with plants. Plant species in these areas are typical for the southwestern desert area. Edwards AFB, NAWS China Lake, and Ft. Irwin (located in the Mojave Desert area) routinely uses their target sites for flight and weapons systems testing. Because these target sites are generally devoid of plants and habitat for wildlife, significant impacts are not expected. There are no records of direct impacts to plants or sensitive species resulting from the use of these targets and test sites. Because natural resources are similar on these DoD ranges and there is a lack of any identified impacts, UAV flight operations that use the target sites would have a less than significant impact on the plant species surrounding the target area. If a Mohave ground squirrel, desert tortoise, or other sensitive or endangered species were struck by debris or the effects from a weapon system, they could be injured or killed. However, mitigation measures coordinated with and approved by the USFWS would be implemented to minimize this type of potential cumulative impact. As note above, approximately one-third of the 9.4 million acres of the West Mojave Plan is located on military bases. As such, the protection for the desert tortoise, Mohave ground squirrel, and other species endemic to the area is implemented into operating procedures, test plans, and Air Force guidance, thus minimizing the potential for cumulative impacts.

Even though additional wilderness areas are proposed for designation under the California Wild Heritage Wilderness Act of 2003, they would not result in additional cumulative impacts associated with the routine and recurring UAV flight operations. The Air Force and flight activities departing from Edwards AFB that operate within the R-2508 Complex would continue to be governed by flight restrictions over wilderness areas.

Cumulative noise impacts on wildlife are not expected. Cumulative noise resulting from the runway replacement project would be limited to disturbed areas, roadways, and burrow pits. Wildlife in these areas is limited; thus the potential for impacts would also be limited. The numbers of future flight operations are consistent with current and projected flight activities. Although most of the operations would be above 3,000 feet AGL, the noise may produce a startle effect in some species. Studies have shown that wildlife acclimate to noise or leave the area of high noise. Most of the noise that would potentially affect wildlife would typically occur when the UAVs and chase aircraft were taking-off and landing on runways at Edwards AFB or below 1,000 feet AGL. In other phases of the flight operations (other than take-off and landing) the UAVs and chase aircraft would typically be above 3,000 feet AGL—except for approximately 5 percent of the flights—thus minimizing the potential for affecting wildlife. Mitigation measures that minimize potential noise impacts from flight operations are identified in the R-2508 Complex User's Handbook (Edwards AFB 2001).

4.7.3.4 Noise

Several sources of noise were evaluated to determine if, when considered comprehensively, they would result in cumulative noise impacts. These include aircraft, transportation, construction, and detonation-related noise. The noise impacts of bombs, rockets, and missile detonations and sonic booms can result in a similar response. Noise from these sources is measured in pounds per square foot and is impulsive. As such, these impacts are considered together.

The aircraft generating sonic booms which impact the ROI operate in the High Altitude Supersonic Corridor, which lies directly above Edwards AFB. These aircraft are primarily the T-38, F-15, F-16, F-18, and F-22; they are flown at altitudes typically above 30,000 feet above MSL and speeds that range from Mach 1.0 to 2.0 (678 to 1,356 miles per hour) in specific designated areas. These flights generate sonic booms with intensities up to approximately 2.5 psf, which is of the same general intensity as the loudest sound expected from a UAV flight operation. Currently, no UAVs fly at supersonic speeds. If, in the future, supersonic UAVs are developed they would be expected to be a very small percentage of the total number of proposed flight operations. In the *EA to Extend the Supersonic Speed Waiver for Continued Operations in the Black Mountain Supersonic Corridor and Alpha Corridor/Precision Impact Range* (AFFTC 2001) it was estimated that over 600 supersonic flights were conducted through this area annually. From 1997 through April 2001, only 56 noise complaints were received from persons within 50 miles of the corridors. Use of the local supersonic corridor by these aircraft does create additional noise impacts; however analysis has shown these noise levels do not create a significant adverse impact

(AFFTC 2001). The addition of up to 528 flight operations would also create additional noise impacts; however only a small percentage of those flight operations (approximately 24 to 48 flights per year, averaging less than one per week) would create sonic booms. Based on past experience the average of less than one additional sonic boom per week would not create a significant adverse noise impact.

Construction activities for the replacement runway at Edwards AFB would increase the noise levels for the duration of the replacement process. However, it would only last until the end of 2008. Because major construction activities are not anticipated in support of these UAV flight operations, additional construction-related noise would not have a cumulative environmental impact past 2008.

The addition of noise generated from up to 528 flight operations per year resulting from testing of bombs, rockets, or missiles would increase the noise in the ROI; however, this additional increase would add to the noise in the ROI only for very brief periods of time and would be less than significant. It must be noted, however, that target areas on the DoD ranges are located in extremely remote areas and the closest off-range inhabitants are miles from the targets. The noise values that would result from these flights are lower than ambient noise created from other civilian noise sources. Therefore, less than significant cumulative noise impacts are anticipated under the UAV Flight Operations at Edwards AFB Program.

4.8 UNAVOIDABLE ADVERSE IMPACTS

Unavoidable adverse impacts include those impacts that are negative, occurring regardless of any identified minimization measures. Unavoidable impacts on natural resources are likely to occur.

The Proposed Action would likely prevent the re-growth of small areas of terrestrial plant communities and reintroduction of any wildlife habitat to various target sites. Typically, the launch sites, landing sites, and target areas for UAV flight activities have been previously disturbed, so the plant communities are of marginal quality for wildlife.

4.9 SHORT-TERM IMPACTS OR USES VERSUS LONG-TERM PRODUCTIVITY OF THE ENVIRONMENT

Examples of short-term uses of the environment include direct, construction-related disturbances and direct impacts associated with the indirect increase in population and activity that occurs over a period typically less than 5 years. Long-term uses of the environment include impacts occurring over a period of more than 5 years, including permanent resource loss.

Since no new development would be required under the UAV Flight Operations Program and current Air Force or contractor personnel from other bases would be used for the program, neither Alternative A, B, C, or D would involve any short- or long-term changes in population or productivity of the environment.

4.10 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Irreversible and irretrievable resource commitments are related to the use of nonrenewable natural resources and the effects that the use of those resources will have on future generations. Irreversible effects primarily result from the use or destruction of a specific resource (e.g., fuel and minerals) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of implementing an action (e.g., extinction of a rare or threatened species, or the disturbance of an important cultural resource site). In accordance with NEPA (40 CFR 1502.16), this section includes a discussion of any irreversible and irretrievable commitment of resources associated with the proposed project.

This programmatic EA only addresses the flight operations of UAVs on DoD test ranges, restricted areas, warning areas, and the transiting of UAVs between these areas. Implementing any of these proposed actions would not require an irreversible or irretrievable commitment of resources. Implementation of Alternative D (No-Action Alternative) would also not require an irreversible or irretrievable commitment of resources.

5.0 REFERENCES

95th Air Base Wing and Air Force Flight Test Center (95 ABW and AFFTC)

2005a *R-2508 Complex Environmental Baseline Study, Edwards Air Force Base, California.* Document on file at 95 ABW/CEV technical library, Edwards AFB, CA.

95th Air Base Wing and Air Force Flight Test Center (95 ABW and AFFTC)

2005b *Environmental Assessment for Armed Munitions Integration Testing on the Precision Impact Range Area.* On File at 95th ABW/CEV technical library. May.

95th Air Base Wing and Air Force Flight Test Center (95 ABW and AFFTC)

2005c *Environmental Assessment for Low-Level Flight Testing, Training, and Evaluation at Edwards AFB.* On File at 95 ABW/CEV technical library. May.

Air Force Center for Environmental Excellence (AFCEE)

2001 *Environmental Assessment/F-22 Initial Operational Test and Evaluation*. Brooks City-Base, San Antonio, Texas. September.

Air Force Safety Center

2003 RQ-1 and F-16 Class A Mishap History. U.S. Air Force Safety Center. Accessed at http://safety.kirtland.af.mil/AFSC/RDBMS/Flight/stats/.

Air Force Flight Test Center (AFFTC)

1998a *Edwards Air Force Hazardous Waste Management Plan.* Document on file at 95 ABW/CEV technical library, Edwards AFB, CA. June.

Air Force Flight Test Center (AFFTC)

1998b *Environmental Assessment for the Continued Use of Restricted Area R-2515*. On file at 95th ABW/CEV technical library.

Air Force Flight Test Center (AFFTC)

2001 *Environmental Assessment to Extend the Supersonic Speed Waiver for Continued Operations in the Black Mountain Supersonic Corridor and Alpha Corridor/Precision Impact Range Area.* Document on file at 95 ABW/CEV technical library, Edwards, AFB, CA. April.

Air Force Flight Test Center (AFFTC)

2003 *Semiannual Mobile Source Air Emissions Inventory for Edwards Air Force Base*. July and December.

Air Force Flight Test Center and Edwards Air Force Base

2005 Industry Day Briefing of Runway Replacement Project. Edwards AFB, CA. March.

Air Force Flight Test Center

2006 Air Force Flight Test Center AFTO 781 Database-Annual Sorties Flown. March.

Air Force Institute for Environment, Safety and Occupational Health Risk Analysis (AFIERA)

2002 *Aircraft Engine Emissions Estimator*.

Baird, P.H.

1990 *Ecology of the Southern Bight: A Synthesis Interpretation*, Birds. M.D. Daily, D.J. Reish, and J.W. Anderson, eds. University of California Press, Berkley, CA.

Bowles, A.E., Tabachnick, B., and Fidel, S.

1991 *Review of the Effects of Aircraft on Wildlife*. Report No 7500. National Park Service, Denver, CO.

Bowles, A.E., Eckert, S., Starke, L., Berg, E., Wolski, L., and Matesic, J.

1999 Effects of Flight Noise from Jet Aircraft and Sonic Booms on Hearing, Behavior, Heart Rate, and Oxygen Consumption of Desert Tortoises. Report prepared for U.S. Air Force by Hubbs-Sea World Research Institute.

Bureau of Land Management

1980 *The California Desert Conservation Area Plan*. U.S. Department of the Interior, BLM Desert District, Riverside, California.

Bureau of Land Management

2006a *Environmental Assessment Livestock Grazing Authorization, EA Number CA-680-05-82*. U.S. Department of the Interior, BLM Barstow Field Office, Barstow, California.

Bureau of Land Management

2006b *Environmental Impact Report for the West Mojave Plan*. U.S. Department of the Interior, BLM California Desert District Office, Moreno Valley, California. Accessed online at http://www.blm.gov/ca/cdd/wemo.html.

California Air Resources Board

2003a "Ambient Air Quality Standards" available at http://www.arb.ca.gov/aqs/aaqs2.pdf. July 9. (Accessed January 18, 2005).

California Air Resources Board

2003b "State Area Designations" available at http://www.arb.ca.gov/desig/adm/adm.htm. December 5. (Accessed January 18, 2005).

California Environmental Protection Agency

2005 "California Almanac of Emissions and Air Quality" website at http://www.arb.ca.gov/aqd/ almanac/ almanac01/ almanac01.htm. (Accessed January 18, 2005).

Committee on Hearing, Bioacoustics and Biomechanics, Assembly of Behavioral and Social Sciences (CHABA)

1981 *Assessment of Community Noise Response to High-Energy Impulsive Sounds*. National Research Council, National Academy of Sciences, Washington, D.C.

Cross, J.N. and Allen, L.G.

1993 *Ecology of the Southern Bight: A Synthesis Interpretation*, Fishes. M.D. Daily, D.J. Reish, and J.W. Anderson, eds. University of California Press, Berkley, CA.

Defense Advanced Research Projects Agency (DARPA)

2005 *Joint Unmanned Combat Air Systems Successfully Completes X-45A Test Flight Program*, News Release, Arlington, VA. August 11.

Edwards Air Force Base (Edwards AFB)

2002 Updated Threat Summary for Bird Strikes. Cited in Public Health and Safety, *Final Environmental Assessment for Low-Level Flight Testing, Training, and Evaluation, Edwards AFB*, May 2005.

Edwards Air Force Base (Edwards AFB)

2004 *Final Integrated Natural Resources Management Plan*. Document on file at 95 ABW/CEV technical library. September.

Edwards Air Force Base (Edwards AFB)

2005 *R-2508 Complex Users Handbook*. http://r2508.edwards.af.mil.

Federal Aviation Administration (FAA)

2004 *FAA – Aeronautical Information Manual. Official Guide to Basic Flight Information and ATC Procedures*. Effective August 5, 2004.

Federal Aviation Administration (FAA)

2005 *Regulatory/Non-Regulatory Special Use Airspace Areas.* Airspace and Rules, Office of System Operations and Safety. Department of Transportation. August.

Federal Aviation Administration (FAA)

2006 *FAA Aerospace Forecast 2006 to 2017, Workload Tables*. Department of Transportation. May. Accessed at http://www.faa.gov/data_statistics/aviation/aerospace_forecasts/2006-2017/.

Federal Interagency Committee on Noise

1992 *Federal Agency Review of Selected Airport Noise Analysis Issues*. August.

Federal Interagency Committee on Urban Noise (FICUN)

1980 *Guidelines for Considering Noise in Land-Use Planning and Control*. June.

Federal Register

2004 *Approval and Promulgation of Implementation Plans, Finding of Attainment, and Designation of Areas for Air Quality Planning Purposes; 1-Hour Ozone Standard, East Kern County, CA*. Volume 69, No. 78, Rules and Regulations. April 22.

Hagenauer, Larry

2006 Personal communications. Tybrin Corporation. March.

Illman, P.E.

1993 *The Pilot's Air Traffic Control Handbook*, 2nd Edition. TAB books, New York.

Lamps, R. E.

1989 Monitoring the Effects of Military Air Operations at Fallon Naval air Station on the Biota of Nevada. Report by Nevada Department of Wildlife for the U.S. Navy.

Lucas, M.J., and P.T. Calamia

1996 *Military Operations Area and Range Noise Model: NRNMAP User's Manual*. Final. Wright-Patterson AFB, Ohio: AAMRL. A1/OE-MN-1996-0001.

National Aeronautical Charting Office (NACO)

2004a *H-3/H-4 IFR Enroute High Altitude—U.S.*, Washington, D.C.: National Aeronautical Charting Office, Federal Aviation Administration, U.S. Department of Transportation. April 15.

National Aeronautical Charting Office (NACO)

2004b *IFR/VFR Low Altitude Planning Chart.* Washington, D.C.: National Aeronautical Charting Office, Federal Aviation Administration, U.S. Department of Transportation. April 15.

National Aeronautical Charting Office (NACO)

2004c *L-3/L-4 IFR En Route Low Altitude –U.S.* Washington, D.C.: National Aeronautical Charting Office, Federal Aviation Administration, U.S. Department of Transportation. April 15.

National Aeronautics and Space Administration (NASA)

1997 *Environmental Assessment of Aircraft Consolidation at NASA at Dryden Flight Research Center* (DFRC). Department of the Air Force, Edwards, CA.

National Geospatial-Intelligence Agency

2004 *DOD Area Planning AP/IB Chart, Military Training Routes—Western U.S.*, St. Louis, MO: National Imagery and Mapping Agency. April 15.

National Marine Fisheries Service

1997 Endangered and Threatened Species: Listing of evolutional significant units of Westcoast Steelheads. *Federal Register* 62 (159): 43937-43954.

National Marine Fisheries Service and U.S. Fish and Wildlife Service

1992 Recovery Plan for U.S. Pacific Populations of the Kemp's Ridley Sea Turtle. National Marine Fisheries Service. Silver Springs, MD.

National Marine Fisheries Service and U.S. Fish and Wildlife Service

1996a Recovery Plan for U.S. Pacific Populations of the Loggerhead Turtle. National Marine Fisheries Service. Silver Springs, MD.

National Marine Fisheries Service and U.S. Fish and Wildlife Service

1996b Recovery Plan for U.S. Pacific Populations of the Leatherback Turtle. National Marine Fisheries Service. Silver Springs, MD.

National Marine Fisheries Service and U.S. Fish and Wildlife Service

1996c Recovery Plan for U.S. Pacific Populations of the Olive Ridley Turtle. National Marine Fisheries Service. Silver Springs, MD.

National Marine Fisheries Service and U.S. Fish and Wildlife Service

1996d Recovery Plan for U.S. Pacific Populations of the East Pacific Green Turtle. National Marine Fisheries Service. Silver Springs, MD.

Naval Air Station Lemoore

2006 NAS Lemoore Military Operations Area Overview. Accessed online at http:www.lemoore.navy.mil/moa/overview.html on May 5.

Naval Air Station Point Mugu

1997 *Hazardous Waste Management Plan*. On file at Naval Air Warfare Center Weapons Division, China Lake, California.

Naval Air Warfare Center Weapons Division (NAWCWD)

2002 *Environmental Impact Statement/Overseas Environmental Impact Statement Point Mugu Sea Range*. U.S. Navy. Naval Air Warfare Center Weapons Division, China Lake, California. March.

Naval Air Weapons Station and Bureau of Land Management

2003 *Environmental Impact Statement for Proposed Military Operational Increases and Implementation of Associated Comprehensive Land Use and Integrated Natural Resources Management Plans*. November.

Nellis Air Force Base

1994 *An Inventory for Rare, Threatened, Endangered, and Endemic Plants and Unique Communities of Nellis Air Force Bombing and Gunnery Range, Clark, Lincoln, and Nye Counties, Nevada. Volume I*. In partnership with The Nature Conservancy, Legacy Resource Management Program Contract No. M67004-91-D-0010-S401. January.

Nellis Air Force Base

1996a *An Inventory for Rare, Threatened, Endangered, and Endemic Plants and Unique Communities of Nellis Air Force Bombing and Gunnery Range, Clark, Lincoln, and Nye Counties, Nevada. Volume III*. In partnership with Nellis AFB, Nevada Natural Heritage Program, and The Nature Conservancy. January.

Nellis Air Force Base

1996b *Summary of Bird Surveys*, Nellis Air Force Range, January 1996 – June – August.

Occupational Safety and Health Administration (OSHA)

1981 Occupational Noise Exposure; Hearing Conservation Amendment, 29 CFR 1910.95. December. Accessed at http://www.osha.gov/.

Ogden Environmental and Energy Services, Inc.

1997 Airborne Noise Modeling for the Point Mugu Sea Range EIS. Modeling conducted by Ogden Environmental and Energy Services, Inc., Colorado Springs, CO.

Reinke, Dan

2005 Personal communications concerning the expected flights by aircraft using PB-13 for armed munitions integration and test flights. May.

Smith, D.

1977 *A Guide to Marine Coastal Plankton and Marine Invertebrates Larvae*. Kendall/Hunt Publishing Co. Dubuque, Iowa. (Extracted from NACWPNWD 2002)

Smith, L.

2005 Personal communications regarding roles and responsibilities of the Safety Office. May.

United States Fauna

2005 Article on “Mohave Ground Squirrel” http://www.unitedstatesfauna.com/ mohavegroundsquirrel.php (accessed May).

U.S. Air Force

1994 Environmental Assessment for Supersonic Flight over the Nellis Range Complex, Nellis Air Force Base, Las Vegas, Nevada.

U.S. Air Force

1995a *Environmental Assessment for the Continued Supersonic Operations in the Panamint Valley Military Operating Area (MOA)*. Prepared by Air Force Flight Test Center, Edwards Air Force Base, CA.

U.S. Air Force

1995b *Environmental Compliance Assessment and Management Program (ECAMP), Preliminary Environmental Findings for Edwards AFB, California*. Prepared by AFFTC/EMC Environmental Compliance Division, April. Document on file at AFFTC/EM, Edwards AFB, CA.

U.S. Air Force

1999 *Renewal of the Nellis Air Force Range Land Withdrawal Final Legislative Environmental Impact Statement.* Nellis AFB, Las Vegas, Nevada.

U.S. Air Force

2001a *Global Hawk Main Operating Base Beddown Environmental Assessment*. Prepared for Air Combat Command. March.

U.S. Air Force

2001b *Nellis Air Force Base Plan 126-4 – Integrated Natural Resources Management Plan (INRMP)*. Headquarters Air Warfare Center (ACC). Nellis Air Force Base, Nevada. February.

U.S. Air Force

2002a *Air Emissions Inventory Guidance Document for Mobile Sources at Air Force Installations.* Institute for Environment, Safety, and Occupational Health Risk Analysis. January.

U.S. Air Force

2003a Information from the annual Air Emissions Inventory for Edwards Air Force Base.

U.S. Air Force

2003b *Environmental Assessment for Predator Force Structure Changes at Indian Springs Air Force Auxiliary Field, Nevada*. Air Combat Command. July.

U.S. Air Force

2005 Information from the 2004 annual Air Emissions Inventory for Edwards Air Force Base. On file with 95 ABW/CEVX.

U.S. Air Force

2006a *Environmental Assessment for Testing and Evaluation of Directed Energy Systems Using Laser Technology at Edwards AFB.* Prepared for 95 ABW/CEV. May.

U.S. Air Force

2006b *Environmental Assessment for the Integration and Developmental Testing of High Power Microwave Systems at Edwards AFB.* Prepared for 95 ABW/CEV. May.

U.S. Air Force

2006c *Draft Environmental Assessment for the Installation of New Urban Operations Complex Targets and Unmanned Aerial Vehicle Targets for the Nevada Test and Training Range.* Nellis Air Force Base, Nevada. March.

U.S. Army

2000 *Common Risk Criteria for National Test Ranges Subtitle: Inert Debris*. Risk and Lethality Commonality Team, Range Safety Group, Range Commanders Council. Supplement to Standard 321-00. April.

U.S. Army

2001 *Environmental Noise Management, An Orientation Handbook for Army Facilities*. U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM). May.

U.S. Department of Transportation

2005 Administrator's Fact Book, Federal Aviation Administration, updated quarterly. Assistant Administrator for Financial Services. Accessed at http://www.faa.gov/about/office_org/headquarters_office/aba/admin/factbook/. November.

U.S. Environmental Protection Agency

1974 *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*. EPA-550/9-47-004.

U.S. Environmental Protection Agency

1991 *Compilation of Air Pollutant Emission Factors, AP-42*, Volume II, Part I, Appendix N, *Diesel Powered, Transit Buses*. March.

U.S. Environmental Protection Agency

1999a *Considering Ecological Processes in Environmental Impact Assessments*. Office of Federal Activities, Washington, D.C. July.

U.S. Environmental Protection Agency

1999b Considering Cumulative Impacts in EPA Review of NEPA Documents. U.S. Environmental Protection Agency, Office of Federal Activities (2252A), Washington, D.C. . EPA 315-R-99-002/May 1999. May.

U.S. Environmental Protection Agency

2000 *AP-42: Compilation of Emission Air Pollutant Factors* Volume II: *Mobile Sources*. Updated November 24, 2000.

U.S. Fish and Wildlife Service

1991 *Biological Opinion for Routine Operations and Facility Construction within the Cantonment Areas of Main and South Bases, Edwards AFB, California (1-6-91-28)*. On file at 95 ABW/EM, Edwards AFB, CA.

U.S. Fish and Wildlife Service

1994a *Biological Opinion for the Precision Impact Range Area, Edwards Air Force Base, California*, March. Document on file at AFFTC/EM, Edwards AFB, CA.

U.S. Fish and Wildlife Service

1994b *Guidelines for Handling Desert Tortoises During Construction Projects*. Document on file at 95 ABW/EM, Edwards AFB, CA.

U.S. Fish and Wildlife Service

1996 *Request for Amendment of the Biological Opinion (1-8-94-F-6) for the Precision Impact Range Area, Edwards Air Force Base, California*. February. Document on file at AFFTC/EM, Edwards AFB, CA.

U.S. Forest Service

1992 *Report to Congress: Potential Impacts of Aircraft Overflights of National Forest System Wildernesses*. Prepared pursuant to Public Law 100-91: The National Park Overflights Act of 1987. Washington, D.C., Government Printing Office.

U.S. Forest Service

2004 http://www.fs.fed.us. Accessed December 2004.

6.0 PERSONS AND AGENCIES CONTACTED

Congo, William

2005 Personal communication. U.S. Army Space and Missile Defense Command Public Affairs Office, Huntsville, Alabama. January.

Hagenauer, Larry

2006 Personal and electronic communication. March.

Mattson, Paul

2005 Personal communication on Laser/HPM systems. Tybrin Corporation. Edwards AFB. February/March/April.

Montoya, Kevin

2005 Personal communication on HPM testing and integration requirements. 412 TW/EWA, Edwards, AFB. February/March/April.

Morgan, Dan

2005 Personal communication on Unmanned Aerial Vehicles (UAVs). January/March.

Mork, Brian, Ph.D.

2005 Personal communication on HPM technology. Tybrin Corporation, Edwards, AFB. January/February/March.

Reinke, Dan, Ph.D.

2005 Personal communications on unmanned aerial vehicles. May/October/November/December.

Wilson, Sonja

2005 Tybrin Corporation, Edwards AFB. May.

This page intentionally left blank.

7.0 LIST OF PREPARERS AND FEDERAL EMPLOYEES INVOLVED IN THE REVIEW PROCESS

7.1 LIST OF PREPARERS

Bates, Michelle A., Senior Biologist/Environmental Scientist, Tetra Tech, Inc.

B.S., 1997, Biology, Pepperdine University, Malibu

M.S., 2000, Environmental Science and Management, University of California, Santa Barbara

Years of Experience: 8

Collinson, Thomas B., Vice President, Tetra Tech, Inc.

B.A., 1978, Geology, University of California, Berkeley

M.A., 1986, Geology, University of California, Santa Barbara

Years of Experience: 22

Eldridge, Jacqueline C., Senior Scientist, Tetra Tech, Inc.

B.S., 1971, Biology, Fairleigh Dickinson University, Teaneck, New Jersey

M.S., 1978, Marine Science, Long Island University, Greenvale, New York

M.B.A., 1983, Business Administration, National University, Vista, California

Years of Experience: 28

Ige, Geri K., Senior Graphic Designer, Tetra Tech, Inc.

Fine Arts, University of California, Irvine

Years of Experience: 22

Knight, James W., Principal Environmental Scientist, Tetra Tech, Inc.

B.S., 1974, Southwest Texas State University, San Marcos

M.A., 1981, Business Management, Webster University, Saint Louis

Years of Experience: 30

Randall, Diane, Senior GIS Specialist, Tetra Tech, Inc.

Technical Certificate, Computer Programming, Sawyers College, Ventura

Technical Certificate, Program Management, Moorpark College, Moorpark

Years of Experience: 15

Velazquez, Victor, Environmental Engineer, Tetra Tech, Inc.
B.S.1995, Chemical Engineering, University of California, Santa Barbara
Years of Experience: 6

Warren, Shirley M., Sr. Project Coordinator, Tetra Tech, Inc.
B.A. 1992, Environmental Studies, California State University Sacramento, California
Years of Experience: 11

Walker, Shannon, Environmental Engineer, Tetra Tech, Inc.
B.S., 1999, Chemical Engineering, West Virginia University
B.S., 1999, Civil and Environmental Engineering, West Virginia University
M.S., 2000, Chemical Engineering, West Virginia University
Years of Experience: 5

7.2 LIST OF FEDERAL EMPLOYEES INVOLVED IN THE REVIEW PROCESS

Christensen, Devon 1st Lt., 412 TW/DRP

Dyas, Keith, 95th ABW/CEVX, Environmental Planning

Hagenauer, Larry, 95th ABW/CEVX ,Tybrin Corporation

Hartman, Fred, 412 TW/ENROR

Martin, Gary, NASA Dryden Flight Research Center, X-45 Program Manager

Morgan, Dan, NASA Dryden Flight Research Center, Environmental Planning Office

Morrow, Dave, 412th TW/DOBU, Tybrin Corporation

Mullen, Dan, NASA Dryden Flight Research Center, Environmental Planning Office

Puckett, Gary, 412th TW, Safety Office

Reinke, Dan, 95th ABW/CEVX, Tybrin Corporation

Tamura, Allen, 95th ABW/CEVX, Tybrin Corporation

Theiss, Sue, 95th ABW/CEVX, CH2MHill

Warner, David, 412th TW/DRP

Waters, Paul Maj., 412th TW/ENT

8.0 ACRONYMS AND ABBREVIATIONS

95 ABW	95th Air Base Wing
AFB	Air Force Base
AFCEE	Air Force Center for Environmental Excellence
AFFTC	Air Force Flight Test Center
AFFTCI	Air Force Flight Test Center Instruction
AFI	Air Force Instruction
AFIERA	Air Force Institute for Environment, Safety and Occupational Health Risk Analysis
AFOSH	Air Force Occupational Safety and Health
AGE	aerospace ground equipment
AGL	above ground level
ATC	air traffic control
AVAQMD	Antelope Valley Air Quality Management District
BASH	bird/aircraft strike hazard
BLM	Bureau of Land Management
CFR	Code of Federal Regulations
CNEL	Community Noise Equivalent Level
CO	carbon monoxide
COA	Certificate of Authorization
dB	decibels
dBA	A-weighted decibels
dBC	C-weighted decibels
DFRC	Dryden Flight Research Center
DNL	day-night average noise level (also L_{dn})
DoD	Department of Defense
EA	environmental assessment
EIAP	Environmental Impact Analysis Process

EMR	electromagnetic radiation
EO	Executive Order
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FTS	flight termination system
GBUAB	Great Basin Unified Air Basin
GPS	global positioning system
GPS	global positioning system
GSE	ground support equipment
HUD	Department of Housing and Urban Development
IFR	instrument flight rules
INRMP	Integrated Natural Resources Management Plan
JP-8	jet fuel
J-UCAS	Joint Unmanned Combat Air Systems
KCAPCD	Kern County Air Pollution Control District
km	kilometers
L_{cdn}	C-weighted day-night average noise level
MDAB	Mojave Desert Air Basin
MDAQMD	Mojave Desert Air Quality Management District
MOA	Military Operation Area
MR_NMAP	Military Operation Area Range NOISEMAP
MSL	mean sea level
NAS	National Airspace System
NASA	National Aeronautics and Space Administration

NAWC	Naval Air Weapons Center
NAWS	Naval Air Warfare Station
NCA	Noise Control Act
NEPA	National Environmental Policy Act
NO_2	nitrogen dioxide
NTTR	Nellis Test and Training Range
PEL	permissible exposure limit
PIRA	Precision Impact Range Area
P.L.	Public Law
PM_{10}	particulate matter 10 microns or less in diameter
psf	pounds per square foot
RMCC	Ridley Mission Control Center
ROI	Region of Influence
Sea Range	Naval Air Weapons Center Point Mugu Sea Range
SEL	sound exposure level
SJVAPCD	San Joaquin Valley Air Pollution Control District
SO_2	sulfur dioxide
SUA	special use airspace
UAS	unmanned aircraft systems
UAV	unmanned aerial vehicle
UCAV	Unmanned Combat Air Vehicle
U.S.C.	United States Code
U.S. EPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
VFR	visual flight rules
VOC	volatile organic compound

This page intentionally left blank.

A AIR QUALITY

This page intentionally left blank.

APPENDIX A-1

AIR QUALITY

Evaluating impacts to air quality in the ROI requires knowledge of (1) the types of pollutants being emitted, (2) emission rates of the pollutant source, (3) the proximity of project emission sources to other emission sources, (4) topography, and (5) local and regional meteorological conditions. The area of effect for emissions of inert pollutants (pollutants other than ozone and its precursors) is generally limited to a few miles downwind from the source. The area of effect for ozone generally extends much further downwind. In the presence of solar radiation, the maximum effect of precursor emissions on ozone levels usually occurs several hours after their release, and therefore, many miles from the source.

The U.S. EPA designates all areas of the United States as having air quality better than (attainment) or worse than (non-attainment) the NAAQS. The criteria for non-attainment designation vary by pollutant. An area is (1) in non-attainment for ozone if its NAAQS has been exceeded more than three discontinuous times in 3 years at a single monitoring station and an area is (2) in non-attainment for any other pollutant if its NAAQS has been exceeded more than once per year. Pollutants in an area are often designated as unclassified when there are insufficient ambient air quality data for the U.S. EPA to form a basis for attainment status. The CARB considers an area to be in non-attainment of a CAAQS for a particular pollutant if (1) the standards for ozone, CO (except Lake Tahoe), SO_2 (1- and 24-hour), NO_2, PM_{10}, and visibility reducing particles have been exceeded or (2) the standards for the remaining pollutants have been equaled or exceeded.

Air quality regulations were first promulgated with the CAA. This Act established the NAAQS and delegated the enforcement of air pollution regulations to the states. In areas where the NAAQS are exceeded, the CAA requires preparation of a State Implementation Plan (SIP) that describes how a state will attain the standards within mandated time frames. The CAA Amendments revised the attainment planning process, basing new requirements and compliance dates for reaching attainment upon the severity of the air quality standard violation.

Federal conformity guidelines included in the CAA Amendments state that a federal agency cannot support an activity unless the agency determines that the activity will conform to the state's most recent SIP approved by the U.S. EPA within the region of the proposed action. These guidelines state that federally supported or funded activities must show that the proposed actions will not (1) cause or

contribute to any new air quality standard violation in any area, (2) interfere with programs outlined in any SIP for maintenance of any standard, (3) increase the frequency or severity of any existing standard violation in any area, or (4) delay the timely attainment of any standard or any required interim emission reductions or other milestones in any area. The activities proposed herein are considered exempt from this rule as long as there is no increase in emissions above the *de minimis* levels specified in the rule. Therefore, a screening to determine the applicability of the conformance guidelines was performed. Table A-12 presents the *de minimis* threshold levels presented in the conformity rule for non-attainment areas.

Ensuring reasonably foreseeable direct and indirect emissions do not exceed the *de minimis* thresholds comprises only half of the screening process. In addition to this requirement, a federal action must also not be considered regionally significant. A regionally significant action is defined as a federal action for which direct and indirect emissions of any pollutant represent 10 percent or more of a nonattainment or maintenance area's emissions inventory for that pollutant.

If a federal action meets both of the abovementioned criteria, it is exempt from further conformity analysis pursuant to 40 CFR Part 93.153. However, although an action may be considered exempt, should it be altered in any way that causes an increase in the reasonably foreseeable emissions, or if attainment areas are reclassified based on changes to NAAQS or the EPA-approved SIP, a revision to the conformity analysis may be required.

The National and California Ambient air quality standards are shown in Table A-11.

Table A-11

National/California Ambient Air Quality Standards

Attainment Designations for R-2508

County	Ozone	CO	NO_2	SO_2	PM_{10}
Kern County/MDAB[(a)]					
National	N/A[c]	U*	U*	U	N
California	N	U/A	A	A	U/N
Tulare County/SJVAB					
National	N	A	A	A	N
California	N	A	A	A	N
Fresno County/SJVAB					
National	N	A	A	A	N
California	N	A	A	A	N
Inyo County/GBVAB					
National	A	A	A	A	N
California	U	A	A	A	N
Los Angeles/MDAB					
National	N	U*	U*	U	U
California	N	A	A	A	N
San Bernardino County/ MDAB[(b)]					
National	N	U*	U*	U	N
California	N	A	A	A	N

Notes: Designation status: A=attainment, N=non-attainment, U=unclassified, and U*=unclassified/attainment.

a – With regard to the CAAQS for CO, the eastern portion of the county, located in the MDAB, is unclassified while the western portion of the county is in attainment. With regard to the NAAQS for PM_{10}, the entire county within the MDAB is unclassified for the federal standard, except the Searles Valley Planning Area, which is non-attainment.

b – With regard to the NAAQS for ozone, the southwestern portion of San Bernardino County within the MDAB is non-attainment, and the northwestern and eastern portion are considered unclassified/attainment. The area was recently determined to be in attainment for the 1-hour national ozone standard but remains in non-attainment of the 8-hour standard. Therefore, for the purpose of this screening process, the area was considered to remain in non-attainment for ozone.

c – The eastern portion of Kern County was recently re-designated as in attainment and is now in maintenance. Therefore, it was included in the conformity screening to insure it conforms to the most recently U.S. EPA-approved SIP.

CO – carbon monoxide
MDAB – Mojave Desert Air Basin
NO_2 – nitrogen dioxide
PM_{10} – particulate matter equal to or less than 10 microns in diameter
SO_2 – sulfur dioxide

Source: California Air Resources Board 2003b. This information was supplemented with the latest information obtained from the *Federal Register*, April 22, 2004.

Sources of emissions shown in Table A-12 include:

- Privately owned vehicles of current Air Force, NASA DFRC, or contractor personnel required for temporary duty for weapons support;
- One takeoff and landing cycle (LTO) for each UAV flight operation;
- One LTO and one touch and go (TGO) for the chase aircraft;
- Aerospace ground equipment (AGE);
- Ground support equipment (GSE) used for loading and unloading systems (consisting of one light-duty gasoline vehicle, one light-duty gasoline truck, one heavy-duty gasoline truck, and one light-duty diesel truck); and
- Generators used to produce the power.

Engine emission factors were multiplied by:

- The total number of operations expected to occur per test and evaluation event;
- The number of engines operating during a particular operation;
- The time in each engine mode and expected fuel flow for the particular operation; and

The estimated amount of time the flights are expected to be below 3,000 feet AGL.

Table A-12

Conformity Applicability for Total Emission Sources 2006 -2012

	Emissions (tons/year)				
Year	**NO_2**	**VOC_s**	**PM_{10}**	**SO_2**	**CO**
2006					
UAV/Aircraft[1]	1.42	0.31	0.18	0.03	1.04
Mobile[2]	0.10	0.17	1.11		1.28
Stationary[3]	0.79	0.02	0.07	0.08	0.05
Total	**2.31**	**0.05**	**1.36**	**0.11**	**2.37**
2007					
UAV/Aircraft[1]	2.79	0.72	0.36	0.05	2.29
Mobile[2]	0.14	0.21	1.57		1.80
Stationary[3]	1.12	0.03	0.10	0.08	0.08
Total	**4.05**	**0.96**	**2.03**	**0.13**	**4.17**
2008					
UAV/Aircraft[1, a]	3.52	0.92	0.46	0.07	2.90
Mobile[2]	0.18	0.30	1.99		2.29
Stationary[3]	1.46	0.04	0.13	0.11	0.10
Total	**5.16**	**1.26**	**2.58**	**0.18**	**5.29**
2009					
UAV/Aircraft[1, a]	4.10	1.04	0.53	0.09	3.29
Mobile[2]	0.23	0.37	2.47		2.85
Stationary[3]	1.85	0.05	0.16	0.14	0.13
Total	**6.18**	**1.46**	**3.16**	**0.23**	**6.27**
2010					
UAV/Aircraft[1,a]	4.30	1.06	0.56	0.10	3.40
Mobile[2]	0.24	0.39	2.61		3.01
Stationary[3]	2.02	0.05	0.18	0.15	0.14
Total	**6.56**	**1.50**	**3.25**	**0.25**	**6.55**
2011					
UAV/Aircraft[1,a]	4.47	1.17	0.59	0.11	3.67
Mobile[2]	0.28	0.46	3.07		3.54
Stationary[3]	3.37	0.08	0.29	0.25	0.23
Total	**8.12**	**1.71**	**3.95**	**0.36**	**7.44**
2012					
UAV/Aircraft[1,] a	3.79	1.09	0.53	0.10	2.38
Mobile[2]	0.26	0.43	2.88		3.32
Stationary[3]	3.37	0.08	0.29	0.25	0.23
Total	**7.42**	**1.60**	**3.70**	**0.35**	**6.93**

Table A-12, Page 1 of 2

Table A-12 (Continued)

Conformity Applicability for Total Emission Sources 2006 -2012

	Emissions (tons/year)				
Year	**NO_2**	**VOC_s**	**PM_{10}**	**SO_2**	**CO**
De minimis threshold AVAQMD	25	25	N/A	N/A	N/A
De minimis threshold KCAPCD	100	100	N/A	N/A	N/A
Percent of De minimis threshold					
Year 2006	9.2	0.2	N/A	N/A	N/A
Year 2007	16.2	3.8	N/A	N/A	N/A
Year 2008	20.6	5.0	N/A	N/A	N/A
Year 2009	24.7	5.8	N/A	N/A	N/A
Year 2010	26.2	6.0	N/A	N/A	N/A
Year 2011	32.4	6.8	N/A	N/A	N/A
Year 2012	29.6	6.4	N/A	N/A	N/A
AVAQMD inventory[b]	10,220	12,775	N/A	N/A	N/A
Kern County MDAB portion of inventory[c]	10,950	4,380	N/A	N/A	N/A
Percent of inventory[d]					
Year 2006	0.022	0.011	N/A	N/A	N/A
Year 2007	0.039	0.022	N/A	N/A	N/A
Year 2008	0.050	0.029	N/A	N/A	N/A
Year 2009	0.060	0.033	N/A	N/A	N/A
Year 2010	0.064	0.034	N/A	N/A	N/A
Year 2011	0.079	0.039	N/A	N/A	N/A
Year 2012	0.073	0.037	N/A	N/A	N/A

Table A-12, Page 2 of 2

Notes: 1- Based on the number of flights shown in Table 2-1 for UAVs and chase aircraft.

2- Based on half the number of flights shown in Table 2-1 for UAVs and chase aircraft requiring up to 4 vehicles traveling 50 miles each to assist with the recovery of the UAV or to service a UAV target site.

3 - Based on source emissions from one diesel generator operating for 4 hours for each UAV flight operation multiplied by the number of flights shown in Table 2-1.

a – Does not include emissions above 3,000 feet AGL.

b – Expected inventory based on 1994 California SIP and CARB 2000 estimated average annual emission.

c –Inventory for 2005 based on CARB 2005 Almanac Data (Cal/EPA 2005).

d- Percentage of inventory is based on the lowest value for KCAPCD (MDAB portion) and AVAQMD.

CO – carbon monoxide

N/A – not applicable

NA – not available

NO_x – nitrogen oxides

PM_{10} – particulate matter 10 microns or less in diameter

SO_x – sulfur oxides

VOC – volatile organic compound

Emissions generated by these sources would be unavoidable; however, based on the evaluation of the emission levels as shown in Table A-12 they would be less than significant as compared to the *de minimis* levels for the different air districts where the UAV would operate.

Table A-1
MQ-9 Predator Aircraft Flight Activity and Emissions for Edwards AFB
Small UAVs (less than 10,000 pounds gross takeoff weight)

Aircraft Type	Engine Type	Number of Engines	Mode of Operation	Number of Operations per Sortie	Emission Factors (lbs/hr)				
					NOx	VOCs	PM_{10}	SOx	CO
MQ-9	Honeywell TPE 331-10T	1	LTO	1	0.56	1.59	0.09	0.05	2.50
			Intermediate (Cruise)	1	2.80	-	0.40	0.22	0.48
			TGO	4	0.48	0.05	0.06	0.03	0.53

Year	Total Flights	Time in Restricted Airspace (hours)	Number of Sorties		Emissions (tons)				
					NOx	VOCs	PM_{10}	SOx	CO
2006	152	4	20	LTO	0.006	0.016	0.001	0.001	0.025
				TGO	0.019	0.002	0.002	0.001	0.021
				R-2508	0.090	0.000	0.013	0.007	0.015
				NTTR	0.011	0.000	0.002	0.001	0.002
				Pt Mugu Sea Range	0.011	0.000	0.002	0.001	0.002
		Total Emissions Per Year (tons)			**0.14**	**0.02**	**0.02**	**0.01**	**0.07**

Year	Total Flights	Time in Restricted Airspace (hours)	Number of Sorties		Emissions (tons)				
					NOx	VOCs	PM_{10}	SOx	CO
2007	205	4	30	LTO	0.008	0.024	0.001	0.001	0.038
				TGO	0.029	0.003	0.004	0.002	0.032
				R-2508	0.134	0.000	0.019	0.011	0.023
				NTTR	0.017	0.000	0.002	0.001	0.003
				Pt Mugu Sea Range	0.017	0.000	0.002	0.001	0.003
		Total Emissions Per Year (tons)			**0.21**	**0.03**	**0.03**	**0.02**	**0.10**

Year	Total Flights	Time in Restricted Airspace (hours)	Number of Sorties		Emissions (tons)				
					NOx	VOCs	PM_{10}	SOx	CO
2008	387	4	50	LTO	0.014	0.040	0.002	0.001	0.063
				TGO	0.048	0.005	0.006	0.003	0.053
				R-2508	0.224	0.000	0.032	0.018	0.038
				NTTR	0.028	0.000	0.004	0.002	0.005
				Pt Mugu Sea Range	0.028	0.000	0.004	0.002	0.005
		Total Emissions Per Year (tons)			**0.34**	**0.04**	**0.05**	**0.03**	**0.16**

Year	Total Flights	Time in Restricted Airspace (hours)	Number of Sorties		Emissions (tons)				
					NOx	VOCs	PM_{10}	SOx	CO
2009	455	4	75	LTO	0.021	0.060	0.003	0.002	0.094
				TGO	0.072	0.008	0.009	0.005	0.080
				R-2508	0.336	0.000	0.048	0.026	0.058
				NTTR	0.042	0.000	0.006	0.003	0.007
				Pt Mugu Sea Range	0.042	0.000	0.006	0.003	0.007
		Total Emissions Per Year (tons)			**0.51**	**0.07**	**0.07**	**0.04**	**0.25**

Year	Total Flights	Time in Restricted Airspace (hours)	Number of Sorties		Emissions (tons)				
					NOx	VOCs	PM_{10}	SOx	CO
2010	485	4	90	LTO	0.025	0.072	0.004	0.002	0.113
				TGO	0.086	0.009	0.011	0.005	0.095
				R-2508	0.403	0.000	0.058	0.032	0.069
				NTTR	0.050	0.000	0.007	0.004	0.009
				Pt Mugu Sea Range	0.050	0.000	0.007	0.004	0.009
		Total Emissions Per Year (tons)			**0.62**	**0.08**	**0.09**	**0.05**	**0.29**

Year	Total Flights	Time in Restricted Airspace (hours)	Number of Sorties		Emissions (tons)				
					NOx	VOCs	PM_{10}	SOx	CO
2011	528	4	100	LTO	0.028	0.080	0.005	0.003	0.125
				TGO	0.096	0.010	0.012	0.006	0.106
				R-2508	0.448	0.000	0.064	0.035	0.077
				NTTR	0.056	0.000	0.008	0.004	0.010
				Pt Mugu Sea Range	0.056	0.000	0.008	0.004	0.010
		Total Emissions Per Year (tons)			**0.68**	**0.09**	**0.10**	**0.05**	**0.33**

Year	Total Flights	Time in Restricted Airspace (hours)	Number of Sorties		Emissions (tons)				
					NOx	VOCs	PM_{10}	SOx	CO
2012	495	4	100	LTO	0.028	0.080	0.005	0.003	0.125
				TGO	0.096	0.010	0.012	0.006	0.106
				R-2508	0.448	0.000	0.064	0.035	0.077
				NTTR	0.056	0.000	0.008	0.004	0.010
				Pt Mugu Sea Range	0.056	0.000	0.008	0.004	0.010
		Total Emissions Per Year (tons)			**0.68**	**0.09**	**0.10**	**0.05**	**0.33**

Table A-2

X-45 Aircraft Flight Activity and Emissions for Edwards AFB

Medium UAVs (10,000 - 20,000 pounds gross takeoff weight)

Aircraft Type	Engine Type	Number of Engines	Operation Cycle	Mode of Operation	Fuel Flow (lbs/min)	Emission Factors (lbs/1,000 lbs of fuel)				
						NOx	ROGs	PM_{10}	SOx	CO
X-45	F404-GE-102D	1	LTO	Takeoff (Mil)	126.95	22.27	0.24	1.61	0.10	1.33
				Climb Out (Int)	108.38	15.92	0.27	1.57	0.10	1.32
				Approach	51.83	7.14	0.85	1.46	0.10	3.17
					10.90	1.43	54.82	4.48	0.10	123.75
					10.90	1.43	54.82	4.48	0.10	123.75

Year	Total Number of Flights	Number of Flights	Operation Cycle	Mode of Operation	Time in Mode (minutes)	Emissions (lbs)				
						NOx	ROGs	PM_{10}	SOx	CO
2006	152	15	LTO	Takeoff (Mil)	1.00	42.41	0.46	3.07	0.18	2.53
				Climb Out (Int)	1.00	25.88	0.44	2.55	0.16	2.15
				Approach	2.00	11.10	1.32	2.27	0.15	4.93
				Idle (Taxi-in)	10.00	2.34	89.63	7.32	0.16	202.33
				Idle (Taxi-out)	10.00	2.34	89.63	7.32	0.16	202.33
				Total Emissions (lbs)		84.07	181.48	22.54	0.80	414.27
				Total Emissions (tons)		**0.04**	**0.09**	**0.01**	**0.00**	**0.21**

Aircraft Type	Engine Type	Number of Engines	Operation Cycle	Mode of Operation	Fuel Flow (lbs/min)	Emission Factors (lbs/1,000 lbs of fuel)				
						NOx	ROGs	PM_{10}	SOx	CO
X-45	F404-GE-102D	1	LTO	Takeoff (Mil)	126.95	22.27	0.24	1.61	0.10	1.33
				Climb Out (Int)	108.38	15.92	0.27	1.57	0.10	1.32
				Approach	51.83	7.14	0.85	1.46	0.10	3.17
				Idle (Taxi-in)	10.90	1.43	54.82	4.48	0.10	123.75
				Idle (Taxi-out)	10.90	1.43	54.82	4.48	0.10	123.75

Year	Total Number of Flights	Number of Flights	Operation Cycle	Mode of Operation	Time in Mode (minutes)	Emissions (lbs)				
						NOx	ROGs	PM_{10}	SOx	CO
2007	205	45	LTO	Takeoff (Mil)	1.00	127.22	1.37	9.20	0.55	7.60
				Climb Out (Int)	1.00	77.65	1.32	7.66	0.47	6.44
				Approach	2.00	33.31	3.97	6.81	0.45	14.79
				Idle (Taxi-in)	10.00	7.01	268.89	21.97	0.47	606.99
				Idle (Taxi-out)	10.00	7.01	268.89	21.97	0.47	606.99
				Total Emissions (lbs)		252.21	544.44	67.61	2.41	1,242.81
				Total Emissions (tons)		**0.13**	**0.27**	**0.03**	**0.00**	**0.62**

Table A-3
X-47 Aircraft Flight Activity and Emissions for Edwards AFB
Medium UAVs (10,000 - 20,000 pounds gross takeoff weight)

Aircraft Type	Engine Type	Number of Engines	Operation Cycle	Mode of Operation	Fuel Flow (lbs/min)	Emission Factors (lbs/1,000 lbs of fuel)				
						NOx	ROGs	PM_{10}	SOx	CO
				Takeoff (Mil)	161.32	29.32	1.79	1.33	0.96	0.86
				Climb Out (Int)	96.17	22.18	2.89	2.06	0.96	0.86
X-47	F100-PW-220E	1	LTO	Approach	63.95	12.53	5.12	2.63	0.96	1.92
					18.07	4.61	7.94	2.06	0.96	35.30
					18.07	4.61	7.94	2.06	0.96	35.30

Year	Total Number of Flights	Number of Flights	Operation Cycle	Mode of Operation	Time in Mode (minutes)	Emissions (lbs)				
						NOx	ROGs	PM_{10}	SOx	CO
				Takeoff (Mil)	1.00	70.95	4.33	3.22	2.32	2.08
				Climb Out (Int)	1.00	31.99	4.17	2.97	1.38	1.24
2006	152	15	LTO	Approach	2.00	24.04	9.82	5.05	1.84	3.68
				Idle (Taxi-in)	10.00	12.49	21.52	5.58	2.60	95.66
				Idle (Taxi-out)	10.00	12.49	21.52	5.58	2.60	95.66
				Total Emissions (lbs)		151.97	61.36	22.40	10.75	198.33
				Total Emissions (tons)		**0.08**	**0.03**	**0.01**	**0.01**	**0.10**

Aircraft Type	Engine Type	Number of Engines	Operation Cycle	Mode of Operation	Fuel Flow (lbs/min)	Emission Factors (lbs/1,000 lbs of fuel)				
						NOx	ROGs	PM_{10}	SOx	CO
				Takeoff (Mil)	161.32	29.32	1.79	1.33	0.96	0.86
				Climb Out (Int)	96.17	22.18	2.89	2.06	0.96	0.86
X-47	F100-PW-220E	1	LTO	Approach	63.95	12.53	5.12	2.63	0.96	1.92
				Idle (Taxi-in)	18.07	4.61	7.94	2.06	0.96	35.30
				Idle (Taxi-out)	18.07	4.61	7.94	2.06	0.96	35.30

Year	Total Number of Flights	Number of Flights	Operation Cycle	Mode of Operation	Time in Mode (minutes)	Emissions (lbs)				
						NOx	ROGs	PM_{10}	SOx	CO
				Takeoff (Mil)	1.00	212.84	12.99	9.65	6.97	6.24
				Climb Out (Int)	1.00	95.98	12.51	8.91	4.15	3.72
2007	205	45	LTO	Approach	2.00	72.12	29.47	15.14	5.53	11.05
				Idle (Taxi-in)	10.00	37.48	64.55	16.75	7.80	286.99
				Idle (Taxi-out)	10.00	37.48	64.55	16.75	7.80	286.99
				Total Emissions (lbs)		455.90	184.07	67.20	32.26	594.99
				Total Emissions (tons)		**0.23**	**0.09**	**0.03**	**0.02**	**0.30**

Table A-4
Global Hawk Aircraft Flight Activity and Emissions for Edwards AFB
Large UAVs (15,000 - 35,000 pounds gross takeoff weight)

Aircraft Type	Engine Type	Number of Engines	Operation Cycle	Mode of Operation	Fuel Flow (lbs/min)	Emission Factors (lbs/1,000 lbs of fuel)				
						NOx	ROGs	PM_{10}	SOx	CO
				Takeoff (Mil)	34.33	15.06	0.01	1.58	0.40	0.45
				Climb Out (Int)	27.33	12.35	0.01	1.58	0.40	0.69
RQ-4 Global Hawk	AE-3007H	1	LTO	Approach	20.17	9.57	0.02	1.58	0.40	1.20
					11.00	6.02	0.02	1.58	0.40	3.33
					11.00	6.02	0.02	1.58	0.40	3.33

Year	Total Number of Flights	Number of Flights	Operation Cycle	Mode of Operation	Time in Mode (minutes)	Emissions (lbs)				
						NOx	ROGs	PM_{10}	SOx	CO
				Takeoff (Mil)	2.00	31.02	0.02	3.25	0.82	0.93
				Climb Out (Int)	1.00	10.13	0.01	1.30	0.33	0.57
2006	152	30	LTO	Approach	5.00	28.95	0.06	4.78	1.21	3.63
				Idle (Taxi-in)	15.00	29.80	0.10	7.82	1.98	16.48
				Idle (Taxi-out)	25.00	49.67	0.17	13.04	3.30	27.47
				Total Emissions (lbs)		149.56	0.35	30.19	7.64	49.08
				Total Emissions (tons)		**0.07**	**0.00**	**0.02**	**0.00**	**0.02**
				Takeoff (Mil)	2.00	46.53	0.03	4.88	1.24	1.39
2007	205	45	LTO	Climb Out (Int)	1.00	15.19	0.01	1.94	0.49	0.85
				Approach	5.00	43.43	0.09	7.17	1.82	5.45
				Idle (Taxi-in)	15.00	44.70	0.15	11.73	2.97	24.73
				Idle (Taxi-out)	25.00	74.50	0.25	19.55	4.95	41.21
				Total Emissions (lbs)		224.35	0.53	45.28	11.46	73.62
				Total Emissions (tons)		**0.11**	**0.00**	**0.02**	**0.01**	**0.04**
				Takeoff (Mil)	2.00	51.70	0.03	5.42	1.37	1.54
				Climb Out (Int)	1.00	16.88	0.01	2.16	0.55	0.94
2008	387	50	LTO	Approach	5.00	48.26	0.10	7.97	2.02	6.05
				Idle (Taxi-in)	15.00	49.67	0.17	13.04	3.30	27.47
				Idle (Taxi-out)	25.00	82.78	0.28	21.73	5.50	45.79
				Total Emissions (lbs)		249.27	0.59	50.31	12.74	81.80
				Total Emissions (tons)		**0.12**	**0.00**	**0.03**	**0.01**	**0.04**
				Takeoff (Mil)	2.00	62.04	0.04	6.51	1.65	1.85
				Climb Out (Int)	1.00	20.25	0.02	2.59	0.66	1.13
2009	455	60	LTO	Approach	5.00	57.91	0.12	9.56	2.42	7.26
				Idle (Taxi-in)	15.00	59.60	0.20	15.64	3.96	32.97
				Idle (Taxi-out)	25.00	99.33	0.33	26.07	6.60	54.95
				Total Emissions (lbs)		299.13	0.71	60.37	15.28	98.16
				Total Emissions (tons)		**0.15**	**0.00**	**0.03**	**0.01**	**0.05**
				Takeoff (Mil)	2.00	72.38	0.05	7.59	1.92	2.16
				Climb Out (Int)	1.00	23.63	0.02	3.02	0.77	1.32
2010	485	70	LTO	Approach	5.00	67.56	0.14	11.15	2.82	8.47
				Idle (Taxi-in)	15.00	69.53	0.23	18.25	4.62	38.46
				Idle (Taxi-out)	25.00	115.89	0.39	30.42	7.70	64.10
				Total Emissions (lbs)		348.98	0.82	70.43	17.83	114.52
				Total Emissions (tons)		**0.17**	**0.00**	**0.04**	**0.01**	**0.06**
				Takeoff (Mil)	2.00	82.72	0.05	8.68	2.20	2.47
				Climb Out (Int)	1.00	27.00	0.02	3.45	0.87	1.51
2011	528	80	LTO	Approach	5.00	77.21	0.16	12.75	3.23	9.68
				Idle (Taxi-in)	15.00	79.46	0.26	20.86	5.28	43.96
				Idle (Taxi-out)	25.00	132.44	0.44	34.76	8.80	73.26
				Total Emissions (lbs)		398.84	0.94	80.50	20.38	130.88
				Total Emissions (tons)		**0.20**	**0.00**	**0.04**	**0.01**	**0.07**
				Takeoff (Mil)	2.00	82.72	0.05	8.68	2.20	2.47
				Climb Out (Int)	1.00	27.00	0.02	3.45	0.87	1.51
2012	495	80	LTO	Approach	5.00	77.21	0.16	12.75	3.23	9.68
				Idle (Taxi-in)	15.00	79.46	0.26	20.86	5.28	43.96
				Idle (Taxi-out)	25.00	132.44	0.44	34.76	8.80	73.26
				Total Emissions (lbs)		398.84	0.94	80.50	20.38	130.88
				Total Emissions (tons)		**0.20**	**0.00**	**0.04**	**0.01**	**0.07**

Table A-5
RQ-4 Global Hawk Emissions

RQ-4, Global Hawk Emissions

AIRCRAFT TYPE	ENGINE TYPE	NUMBER OF ENGINES	OPERATION CYCLE	MODE OF OPERATION	FUEL FLOW (lb/min)	EMISSIONS FACTOR (lb/1000lb Fuel)				
						ROGs	NOx	CO	SOx	PM
RQ-4 Global Hawk	AE-3007H (Notes 1 and 2. Used data for the T406-AD-400)	1	LTO	Take Off	34.33	0.01	15.06	0.45	0.40	1.58
				Climb Out	27.33	0.01	12.35	0.69	0.40	1.58
				Approach	20.17	0.02	9.57	1.20	0.40	1.58
				Idle (Taxi-in)	11.00	0.02	6.02	3.33	0.40	1.58
				Idle (Taxi-out)	11.00	0.02	6.02	3.33	0.40	1.58
			TGO	Take Off	34.33	0.01	15.06	0.45	0.40	1.58
				Climb Out	27.33	0.01	12.35	0.69	0.40	1.58
				Approach	20.17	0.02	9.57	1.20	0.40	1.58

Notes
1. *RQ-4 Global Hawk: Information Sheet -Draft-* , Aircraft Environmental Support Office; San Diego, CA., October 2005, AESO Memorandum Report No. 2006-01.
2. *Aircraft Emission Estimates: V-22 Landing and Takeoff Cycle and In-Frame, Engine Maintenance Testing Using JP-5,* Aircraft Environmental Support Office; San Diego, CA., January 2001, AESO Memorandum Report No. 9946, Revision E.

Table A-5
RQ-4 Global Hawk Emissions

EMISSIONS (tons)

OPERATION CYCLE	NUMBER OPs	TIME IN MODE (min)	EMISSIONS				
			ROGs	NOx	CO	SOx	PM
LTO	1	2.00	3.43333E-07	5.17060E-04	1.54500E-05	1.37333E-05	5.42467E-05
		1.00	1.36667E-07	1.68783E-04	9.43000E-06	5.46667E-06	2.15933E-05
		5.00	1.00833E-06	4.82488E-04	6.05000E-05	2.01667E-05	7.96583E-05
		15.00	1.65000E-06	4.96650E-04	2.74725E-04	3.30000E-05	1.30350E-04
		25.00	2.75000E-06	8.27750E-04	4.57875E-04	5.50000E-05	2.17250E-04
TGO	1	2.00	3.43333E-07	5.17060E-04	1.54500E-05	1.37333E-05	5.42467E-05
		1.00	1.36667E-07	1.68783E-04	9.43000E-06	5.46667E-06	2.15933E-05
		5.00	1.00833E-06	4.82488E-04	6.05000E-05	2.01667E-05	7.96583E-05
EMISSIONS (tons)			7.37667E-06	3.66106E-03	9.03360E-04	1.66733E-04	6.58597E-04

Calculated emissions are not 0, but are less than 1.3 X 10^{-4} ton per operation

Calculation are derived from the following formula:
Emission = number of engines X Fuel Flow X Emission Factor
X Number of Operations X Time in Mode / 1,000 (for lb/1000 lb of fuel)
/ 2,000 (to convert to tons)

Table A-6
F-15 Aircraft Activity and Emissions for Edwards AFB

Aircraft Type	Engine Type	Number of Engines	Operation Cycle	Mode of Operation	Fuel Flow (lbs/min)	Emission Factors (lbs/1,000 lbs of fuel)				
						NOx	ROGs	PM_{10}	SOx	CO
F-15	F-100-PW-100	2	LTO	Takeoff (Mil)	168.40	39.44	0.28	1.33	0.10	0.90
				Climb Out (Int)	126.95	30.89	0.14	2.06	0.10	0.91
				Approach	45.77	12.33	0.16	2.63	0.10	3.49
					18.28	4.38	8.60	2.06	0.10	35.29
					18.28	4.38	8.60	2.06	0.10	35.29
			TGO	Takeoff (Mil)	168.40	39.44	0.28	1.33	0.10	0.90
				Climb Out (Int)	126.95	30.89	0.14	2.06	0.10	0.91
				Approach	45.77	12.33	0.16	2.63	0.10	3.49

Operation Cycle	Number of Operations	Time in Mode (minutes)	Emissions (lbs)				
			NOx	ROGs	PM_{10}	SOx	CO
LTO	1	1.00	13.28	0.09	0.45	0.03	0.30
		1.00	7.84	0.04	0.52	0.02	0.23
		5.00	5.64	0.07	1.20	0.04	1.60
		25.00	4.00	7.86	1.88	0.09	32.26
TGO	1	1.00	13.28	0.09	0.45	0.03	0.30
		0.50	3.92	0.02	0.26	0.01	0.12
		4.00	4.51	0.06	0.96	0.04	1.28
Total Emissions Per Mission (lbs)			***52.49***	***8.23***	***5.73***	***0.27***	***36.08***

Source: All data were extracted from the *Air Emissions Inventory Guidance Document for Mobile Sources at Air Force Installations* , published by the United States Air Force, Institute for Environment, Safety, and Occupational Health Risk Analysis, in January 2002

Year	Number of Chase Flights	Percent Utilized	Emissions (lbs)				
			NOx	ROGs	PM_{10}	SOx	CO
2006	72	0.226	854.16	133.99	93.24	4.36	587.14
2007	140	0.226	1,660.87	260.53	181.30	8.48	1,141.67
2008	172	0.226	2,040.50	320.08	222.74	10.42	1,402.62
2009	195	0.226	2,313.36	362.88	252.52	11.81	1,590.18
2010	200	0.226	2,372.67	372.18	259.00	12.12	1,630.96
2011	198	0.226	2,348.95	368.46	256.41	12.00	1,614.65
2012	165	0.226	1,957.45	307.05	213.67	10.00	1,345.54
	Total emissions (lbs) 2006 - 2012		13,547.96	2,125.17	1,478.88	69.18	9,312.77
	Total F-15 emissions (tons) 2006 - 2012		**6.77**	**1.06**	**0.74**	**0.03**	**4.66**

Note: Percent utilized is based on a 5 year average (1999-2004) of F-15 versus F-16.
Source: Air Force Flight Test Center 2005

Table A-7
F-16 Aircraft Activity and Emissions for Edwards AFB

Aircraft Type	Engine Type	Number of Engines	Operation Cycle	Mode of Operation	Fuel Flow (lbs/min)	Emission Factors (lbs/1,000 lbs of fuel)				
						NOx	ROGs	PM_{10}	SOx	CO
F-16	F-100-PW-200	1	LTO	Takeoff (Mil)	145.28	39.12	0.13	1.33	0.10	0.86
				Climb Out (Int)	90.10	27.60	0.22	2.06	0.10	0.49
				Approach	52.25	13.82	0.26	2.63	0.10	1.38
					16.98	4.99	8.28	2.06	0.10	26.61
					16.98	4.99	8.28	2.06	0.10	26.61
			TGO	Takeoff (Mil)	145.28	39.12	0.13	1.33	0.10	0.86
				Climb Out (Int)	90.10	27.60	0.22	2.06	0.10	0.49
				Approach	52.25	13.82	0.26	2.63	0.10	1.38

Number of Operations	Operation Cycle	Time in Mode (minutes)	Emissions (lbs)				
			NOx	ROGs	PM_{10}	SOx	CO
1	LTO	1.00	5.68	0.02	0.19	0.01	0.12
		1.00	2.49	0.02	0.19	0.01	0.04
		5.00	3.61	0.07	0.69	0.03	0.36
		25.00	2.12	3.51	0.87	0.04	11.30
1	TGO	1.00	5.68	0.02	0.19	0.01	0.12
		0.50	1.24	0.01	0.09	0.00	0.02
		4.00	2.89	0.05	0.55	0.02	0.29
Total Emissions Per Mission (lbs)			***23.71***	***3.70***	***2.78***	***0.13***	***12.26***

Year	Number of Chase Flights	Percent Utilized	Emissions (lbs)				
			NOx	ROGs	PM_{10}	SOx	CO
2006	72	0.774	1,321.53	206.45	154.71	7.06	683.28
2007	140	0.774	2,569.64	401.43	300.82	13.74	1,328.60
2008	172	0.774	3,156.99	493.19	369.57	16.88	1,632.28
2009	195	0.774	3,579.15	559.14	418.99	19.13	1,850.55
2010	200	0.774	3,670.92	573.48	429.74	19.62	1,898.00
2011	198	0.774	3,634.21	567.74	425.44	19.43	1,879.02
2012	165	0.774	3,028.51	473.12	354.53	16.19	1,565.85
	Total emissions (lbs) 2006 - 2012		20,960.96	3,274.55	2,453.80	112.05	10,837.59
	Total F-16 emissions (tons) 2006 - 2012		**10.48**	**1.64**	**1.23**	**0.06**	**5.42**

Note: Percent utilized is based on a 5 year average (1999-2004) of F-15 versus F-16.

Table A-8

Total Expected UAV/Aircraft Emissions

	Emissions (tons/yr)				
Year	**NO_2**	**VOCs**	**PM_{10}**	**SO_2**	**CO**
2006					
MQ-9	0.14	0.02	0.02	0.01	
X-45	0.04	0.09	0.01	0.00	
X-47	0.08	0.03	0.01	0.01	0.10
Global Hawk	0.07	0.00	0.02	0.00	0.02
F-15	0.43	0.07	0.05	0.00	0.29
F-16	0.66	0.10	0.08	0.00	0.34
Total 2006	**1.42**	**0.31**	**0.18**	**0.03**	**0.76**
2007					
MQ-9	0.21	0.03	0.03	0.02	0.10
X-45	0.13	0.27	0.03	0.00	0.62
X-47	0.23	0.09	0.03	0.02	0.30
Global Hawk	0.11	0.00	0.02	0.01	0.04
F-15	0.83	0.13	0.09	0.00	0.57
F-16	1.28	0.20	0.15	0.01	0.66
Total 2007	**2.79**	**0.72**	**0.36**	**0.05**	**2.29**
2008					
MQ-9	0.34	0.04	0.05	0.03	0.16
X-45	0.16	0.35	0.04	0.00	0.80
X-47	0.29	0.12	0.04	0.02	0.38
Global Hawk	0.12	0.00	0.03	0.01	0.04
F-15	1.02	0.16	0.11	0.01	0.70
F-16	1.58	0.25	0.18	0.01	0.82
Total 2008	**3.52**	**0.92**	**0.46**	**0.07**	**2.90**
2009					
MQ-9	0.51	0.07	0.07	0.04	0.25
X-45	0.18	0.38	0.05	0.00	0.87
X-47	0.31	0.13	0.05	0.02	0.41
Global Hawk	0.15	0.00	0.03	0.01	0.05
F-15	1.16	0.18	0.13	0.01	0.80
F-16	1.79	0.28	0.21	0.01	0.93
Total 2009	**4.10**	**1.04**	**0.53**	**0.09**	**3.29**
2010					
MQ-9	0.62	0.08	0.09	0.05	0.29
X-45	0.18	0.38	0.05	0.00	0.87
X-47	0.31	0.13	0.05	0.02	0.41
Global Hawk	0.17	0.00	0.04	0.01	0.06
F-15	1.19	0.19	0.13	0.01	0.82
F-16	1.84	0.29	0.21	0.01	0.95
Total 2010	**4.30**	**1.06**	**0.56**	**0.10**	**3.40**
2011					
MQ-9	0.68	0.09	0.10	0.05	0.33
X-45	0.21	0.45	0.06	0.00	1.04
X-47	0.38	0.15	0.06	0.03	0.50
Global Hawk	0.20	0.00	0.04	0.01	0.07
F-15	1.17	0.18	0.13	0.01	0.81
F-16	1.82	0.28	0.21	0.01	0.94
Total 2011	**4.47**	**1.17**	**0.59**	**0.11**	**3.67**
2012					
MQ-9	0.68	0.09	0.10	0.05	0.33
X-45	0.21	0.45	0.06	0.00	1.04
X-47	0.38	0.15	0.06	0.03	0.50
Global Hawk	0.20	0.00	0.04	0.01	0.07
F-15	0.98	0.15	0.11	0.00	0.67
F-16	1.51	0.24	0.18	0.01	0.78
Total 2012	**3.97**	**1.09**	**0.53**	**0.10**	**3.38**

Table A-9

Related Stationary Source Emissions (on ground)

Year - 2006

Process Description	Fuel Type	Power Rating (BTU/hr)	Operation (hrs)	NO_2 (lb/MMBtu)	NO_2 Emission Rate (tons/year)	CO Emission Rate (ton/year)	SO_2 Emission Rate (ton/year)	PM_{10} Emission Rate (ton/year)	VOC Emission Rate (ton/year)
Generator (MDG4)	Diesel	8,034,000	280	0.698	0.785	0.054	0.057	0.069	0.019
Total			**280**		**0.785**	**0.054**	**0.057**	**0.069**	**0.019**

Year - 2007

Process Description	Fuel Type	Power Rating (BTU/hr)	Operation (hrs)	NO_2 (lb/MMBtu)	NO_2 Emission Rate (tons/year)	CO Emission Rate (ton/year)	SO_2 Emission Rate (ton/year)	PM_{10} Emission Rate (ton/year)	VOC Emission Rate (ton/year)
Generator (MDG4)	Diesel	8,034,000	400	0.698	1.122	0.077	0.082	0.098	0.027
Total			**400**		**1.122**	**0.077**	**0.082**	**0.098**	**0.027**

Year - 2008

Process Description	Fuel Type	Power Rating (BTU/hr)	Operation (hrs)	NO_2 (lb/MMBtu)	NO_2 Emission Rate (tons/year)	CO Emission Rate (ton/year)	SO_2 Emission Rate (ton/year)	PM_{10} Emission Rate (ton/year)	VOC Emission Rate (ton/year)
Generator (MDG4)	Diesel	8,034,000	520	0.698	1.458	0.100	0.107	0.127	0.036
Total			**520**		**1.458**	**0.100**	**0.107**	**0.127**	**0.036**

Year - 2009

Process Description	Fuel Type	Power Rating (BTU/hr)	Operation (hrs)	NO_2 (lb/MMBtu)	NO_2 Emission Rate (tons/year)	CO Emission Rate (ton/year)	SO_2 Emission Rate (ton/year)	PM_{10} Emission Rate (ton/year)	VOC Emission Rate (ton/year)
Generator (MDG4)	Diesel	8,034,000	660	0.698	1.851	0.127	0.135	0.162	0.045
Total			**660**		**1.851**	**0.127**	**0.135**	**0.162**	**0.045**

Table A-9

Related Stationary Source Emissions (on ground)

Year - 2010

Process Description	Fuel Type	Power Rating (BTU/hr)	Operation (hrs)	NO_2 (lb/MMBtu)	NO_2 Emission Rate (tons/year)	CO Emission Rate (ton/year)	SO_2 Emission Rate (ton/year)	PM_{10} Emission Rate (ton/year)	VOC Emission Rate (ton/year)
Generator (MDG4)	Diesel	8,034,000	180	0.698	0.505	0.035	0.037	0.044	0.012
Total			**360**		**0.727**	**0.050**	**0.053**	**0.064**	**0.018**

Year - 2011

Process Description	Fuel Type	Power Rating (BTU/hr)	Operation (hrs)	NO_2 (lb/MMBtu)	NO_2 Emission Rate (tons/year)	CO Emission Rate (ton/year)	SO_2 Emission Rate (ton/year)	PM_{10} Emission Rate (ton/year)	VOC Emission Rate (ton/year)
Generator (MDG4)	Diesel	8,034,000	1200	0.698	3.365	0.231	0.246	0.294	0.082
Total			**1200**		**3.365**	**0.231**	**0.246**	**0.294**	**0.082**

Year - 2012

Process Description	Fuel Type	Power Rating (BTU/hr)	Operation (hrs)	NO_2 (lb/MMBtu)	NO_2 Emission Rate (tons/year)	CO Emission Rate (ton/year)	SO_2 Emission Rate (ton/year)	PM_{10} Emission Rate (ton/year)	VOC Emission Rate (ton/year)
Generator (MDG4)	Diesel	8,034,000	1200	0.698	3.365	0.231	0.246	0.294	0.082
Total			**1200**		**3.365**	**0.231**	**0.246**	**0.294**	**0.082**

Notes:
1 - It was assumed that the MDG4 generator would be used for 4 hours per test.
BTU - British thermal units
CO - carbon monoxide
lb/s - pound/s
NO_2 - nitrogen dioxide
PM_{10} - particulate matter equal to or below 10 microns
SO_2 - sulfur dioxide
VOC - volatile organic compounds

Source: Mr. Darrell Stiff, Chief, Powered Aircraft Ground Equipment, 412 Equipment Maintenance Squadron, Edwards AFB, CA. Personal correspondence with Mr. Larry Hagenauer, EAFB Environmental Contractor, 18 Aug 2004.

Table A-10

Related Mobile Source Emissions (on ground)

Year - 2006

Equipment or Vehicle Type	Rate of Emissions	Number of Vehicles	HP	Vehicle Miles Traveled		Number of Trips	Hours per Day	Emission Type	NO_2 Emission Factor[a]	Total NO_2 Emissions (tons/yr)	SO_2 Emission Factor[a]	Total SO_2 Emissions (tons/yr)	CO Emission Factor[a]	Total CO Emissions (tons/yr)	VOC Emission Factor[a]	Total VOC Emissions (tons/yr)	PM_{10} Emission Factor[a]	Total PM_{10} Emissions (tons/yr)	Entrained PM_{10} Emission Factor[b] (lbs/VMT)		Total Entrained PM_{10} Emissions (tons/yr)	Total PM10
				Paved	Unpaved														Paved	Unpaved		
LDGV, LDGT, &HDGT	g/VMT	3	N/A	40	10	65	N/A	Travel	0.90	0.01	-	-	8.87	0.10	0.91	0.01	0.11	0.00	0.02	0.78	0.82	
	g/VMT							Cold Start	2.77	0.03	-	-	93.49	1.00	5.21	0.06	-	-	-	-	-	
	g/VMT							Hot Start	1.76	0.02	-	-	12.74	0.14	1.38	0.01	-	-	-	-	-	
	g/VMT							Hot Soak	-	-	-	-	-	-	2.11	0.02	-	-	-	-	-	
	g/VMT							Diurnal	-	-	-	-	-	-	5.01	0.05	-	-	-	-	-	
LDDT	g/VMT	1	N/A	40	10	65	N/A	Travel	12.01	0.04	-	-	11.03	0.04	2.78	0.01	2.63	0.01	0.02	0.78	0.27	
	g/VMT							Cold Start	-	-	-	-	-	-	-	-	-	-	-	-	-	
	g/VMT							Hot Soak	-	-	-	-	-	-	-	-	-	-	-	-	-	
	g/VMT							Diurnal	-	-	-	-	-	-	-	-	-	-	-	-	-	
				TOTAL Emissions in tons/year						**0.101**		**-**		**1.277**		**0.167**		**0.011**			**1.099**	**1.1091**

Year - 2007

Equipment or Vehicle Type	Rate of Emissions	Number of Vehicles	HP	Vehicle Miles Traveled		Number of Trips	Hours per Day	Emission Type	NO_2 Emission Factor[a]	Total NO_2 Emissions (tons/yr)	SO_2 Emission Factor[a]	Total SO_2 Emissions (tons/yr)	CO Emission Factor[a]	Total CO Emissions (tons/yr)	VOC Emission Factor[a]	Total VOC Emissions (tons/yr)	PM_{10} Emission Factor[a]	Total PM_{10} Emissions (tons/yr)	Entrained PM_{10} Emission Factor[b] (lbs/VMT)		Total Entrained PM_{10} Emissions (tons/yr)	Total PM10
				Paved	Unpaved														Paved	Unpaved		
LDGV, LDGT, &HDGT	g/VMT	3	N/A	40	10	92	N/A	Travel	0.90	0.01	-	-	8.87	0.13	0.91	0.01	0.11	0.00	0.02	0.78	1.17	
	g/VMT							Cold Start	2.77	0.04	-	-	93.49	1.42	5.21	0.08	-	-	-	-	-	
	g/VMT							Hot Start	1.76	0.03	-	-	12.74	0.19	1.38	0.02	-	-	-	-	-	
	g/VMT							Hot Soak	-	-	-	-	-	-	2.11	0.03	-	-	-	-	-	
	g/VMT							Diurnal	-	-	-	-	-	-	5.01	0.05	-	-	-	-	-	
LDDT	g/VMT	1	N/A	40	10	92	N/A	Travel	12.01	0.06	-	-	11.03	0.06	2.78	0.01	2.63	0.01	0.02	0.78	0.39	
	g/VMT							Cold Start	-	-	-	-	-	-	-	-	-	-	-	-	-	
	g/VMT							Hot Soak	-	-	-	-	-	-	-	-	-	-	-	-	-	
	g/VMT							Diurnal	-	-	-	-	-	-	-	-	-	-	-	-	-	
				TOTAL Emissions in tons/year						**0.143**		**-**		**1.807**		**0.214**		**0.015**			**1.555**	**1.5698**

Year - 2008

Equipment or Vehicle Type	Rate of Emissions	Number of Vehicles	HP	Vehicle Miles Traveled		Number of Trips	Hours per Day	Emission Type	NO_2 Emission Factor[a]	Total NO_2 Emissions (tons/yr)	SO_2 Emission Factor[a]	Total SO_2 Emissions (tons/yr)	CO Emission Factor[a]	Total CO Emissions (tons/yr)	VOC Emission Factor[a]	Total VOC Emissions (tons/yr)	PM_{10} Emission Factor[a]	Total PM_{10} Emissions (tons/yr)	Entrained PM_{10} Emission Factor[b] (lbs/VMT)		Total Entrained PM_{10} Emissions (tons/yr)	Total PM10
				Paved	Unpaved														Paved	Unpaved		
LDGV, LDGT, &HDGT	g/VMT	3	N/A	40	10	117	N/A	Travel	0.90	0.02	-	-	8.87	0.17	0.91	0.02	0.11	0.00	0.02	0.78	1.48	
	g/VMT							Cold Start	2.77	0.05	-	-	93.49	1.81	5.21	0.10	-	-	-	-	-	
	g/VMT							Hot Start	1.76	0.03	-	-	12.74	0.25	1.38	0.03	-	-	-	-	-	
	g/VMT							Hot Soak	-	-	-	-	-	-	2.11	0.04	-	-	-	-	-	
	g/VMT							Diurnal	-	-	-	-	-	-	5.01	0.10	-	-	-	-	-	
LDDT	g/VMT	1	N/A	40	10	117	N/A	Travel	12.01	0.08	-	-	11.03	0.07	2.78	0.02	2.63	0.02	0.02	0.78	0.49	
	g/VMT							Cold Start	-	-	-	-	-	-	-	-	-	-	-	-	-	
	g/VMT							Hot Soak	-	-	-	-	-	-	-	-	-	-	-	-	-	
	g/VMT							Diurnal	-	-	-	-	-	-	-	-	-	-	-	-	-	
				TOTAL Emissions in tons/year						**0.182**		**-**		**2.298**		**0.301**		**0.019**			**1.977**	**1.9964**

Year - 2009

Equipment or Vehicle Type	Rate of Emissions	Number of Vehicles	HP	Vehicle Miles Traveled		Number of Trips	Hours per Day	Emission Type	NO_2 Emission Factor[a]	Total NO_2 Emissions (tons/yr)	SO_2 Emission Factor[a]	Total SO_2 Emissions (tons/yr)	CO Emission Factor[a]	Total CO Emissions (tons/yr)	VOC Emission Factor[a]	Total VOC Emissions (tons/yr)	PM_{10} Emission Factor[a]	Total PM_{10} Emissions (tons/yr)	Entrained PM_{10} Emission Factor[b] (lbs/VMT)		Total Entrained PM_{10} Emissions (tons/yr)	Total PM10
				Paved	Unpaved														Paved	Unpaved		
LDGV, LDGT, &HDGT	g/VMT	3	N/A	40	10	145	N/A	Travel	0.90	0.02	-	-	8.87	0.21	0.91	0.02	0.11	0.00	0.02	0.78	1.84	
	g/VMT							Cold Start	2.77	0.07	-	-	93.49	2.24	5.21	0.12	-	-	-	-	-	
	g/VMT							Hot Start	1.76	0.04	-	-	12.74	0.31	1.38	0.03	-	-	-	-	-	
	g/VMT							Hot Soak	-	-	-	-	-	-	2.11	0.05	-	-	-	-	-	
	g/VMT							Diurnal	-	-	-	-	-	-	5.01	0.12	-	-	-	-	-	
LDDT	g/VMT	1	N/A	40	10	145	N/A	Travel	12.01	0.10	-	-	11.03	0.09	2.78	0.02	2.63	0.02	0.02	0.78	0.61	
	g/VMT							Cold Start	-	-	-	-	-	-	-	-	-	-	-	-	-	
	g/VMT							Hot Soak	-	-	-	-	-	-	-	-	-	-	-	-	-	
	g/VMT							Diurnal	-	-	-	-	-	-	-	-	-	-	-	-	-	
				TOTAL Emissions in tons/year						**0.226**		**-**		**2.848**		**0.373**		**0.024**			**2.451**	**2.4742**

Table A-10

Related Mobile Source Emissions (on ground)

Year - 2010

Equipment or Vehicle Type	Rate of Emissions	Number of Vehicles	HP	Vehicle Miles Traveled		Number of Trips	Hours per Day	Emission Type	NO_2 Emission Factor[a]	Total NO_2 Emissions (tons/yr)	SO_2 Emission Factor[a]	Total SO_2 Emissions (tons/yr)	CO Emission Factor[a]	Total CO Emissions (tons/yr)	VOC Emission Factor[a]	Total VOC Emissions (tons/yr)	PM_{10} Emission Factor[a]	Total PM_{10} Emissions (tons/yr)	Entrained PM_{10} Emission Factor[b] (lbs/VMT)		Total Entrained PM_{10} Emissions (tons/yr)	Total PM10
				Paved	Unpaved														Paved	Unpaved		
LDGV, LDGT, &HDGT	g/VMT	3	N/A	40	10	153	N/A	Travel	0.90	0.02	-	-	8.87	0.22	0.91	0.02	0.11	-	0.02	0.78	1.94	
	g/VMT							Cold Start	2.77	0.07	-	-	93.49	2.37	5.21	0.13	-	-	-	-	-	
	g/VMT							Hot Start	1.76	0.04	-	-	12.74	0.32	1.38	0.03	-	-	-	-	-	
	g/VMT							Hot Soak	-	-	-	-	-	-	2.11	0.05	-	-	-	-	-	
	g/VMT							Diurnal	-	-	-	-	-	-	5.01	0.13	-	-	-	-	-	
LDDT	g/VMT	1	N/A	40	10	153	N/A	Travel	12.01	0.10	-	-	11.03	0.09	2.78	0.02	2.63	0.02	0.02	0.78	0.65	
	g/VMT							Cold Start	-	-	-	-	-	-	-	-	-	-	-	-	-	
	g/VMT							Hot Soak	-	-	-	-	-	-	-	-	-	-	-	-	-	
	g/VMT							Diurnal	-	-	-	-	-	-	-	-	-	-	-	-	-	
				TOTAL Emissions in tons/year						**0.239**		**-**		**3.005**		**0.393**		**0.022**			**2.586**	**2.6079**

Year - 2011

Equipment or Vehicle Type	Rate of Emissions	Number of Vehicles	HP	Vehicle Miles Traveled		Number of Trips	Hours per Day	Emission Type	NO_2 Emission Factor[a]	Total NO_2 Emissions (tons/yr)	SO_2 Emission Factor[a]	Total SO_2 Emissions (tons/yr)	CO Emission Factor[a]	Total CO Emissions (tons/yr)	VOC Emission Factor[a]	Total VOC Emissions (tons/yr)	PM_{10} Emission Factor[a]	Total PM_{10} Emissions (tons/yr)	Entrained PM_{10} Emission Factor[b] (lbs/VMT)		Total Entrained PM_{10} Emissions (tons/yr)	Total PM10
				Paved	Unpaved														Paved	Unpaved		
LDGV, LDGT, &HDGT	g/VMT	3	N/A	40	10	180	N/A	Travel	0.90	0.03	-	-	8.87	0.26	0.91	0.03	0.11	0.00	0.02	0.78	2.28	
	g/VMT							Cold Start	2.77	0.08	-	-	93.49	2.78	5.21	0.16	-	-	-	-	-	
	g/VMT							Hot Start	1.76	0.05	-	-	12.74	0.38	1.38	0.04	-	-	-	-	-	
	g/VMT							Hot Soak	-	-	-	-	-	-	2.11	0.06	-	-	-	-	-	
	g/VMT							Diurnal	-	-	-	-	-	-	5.01	0.15	-	-	-	-	-	
LDDT	g/VMT	1	N/A	40	10	180	N/A	Travel	12.01	0.12	-	-	11.03	0.11	2.78	0.03	2.63	0.03	0.02	0.78	0.76	
	g/VMT							Cold Start	-	-	-	-	-	-	-	-	-	-	-	-	-	
	g/VMT							Hot Soak	-	-	-	-	-	-	-	-	-	-	-	-	-	
	g/VMT							Diurnal	-	-	-	-	-	-	-	-	-	-	-	-	-	
				TOTAL Emissions in tons/year						**0.281**		**-**		**3.535**		**0.463**		**0.029**			**3.042**	**3.0714**

Year - 2012

Equipment or Vehicle Type	Rate of Emissions	Number of Vehicles	HP	Vehicle Miles Traveled		Number of Trips	Hours per Day	Emission Type	NO_2 Emission Factor[a]	Total NO_2 Emissions (tons/yr)	SO_2 Emission Factor[a]	Total SO_2 Emissions (tons/yr)	CO Emission Factor[a]	Total CO Emissions (tons/yr)	VOC Emission Factor[a]	Total VOC Emissions (tons/yr)	PM_{10} Emission Factor[a]	Total PM_{10} Emissions (tons/yr)	Entrained PM_{10} Emission Factor[b] (lbs/VMT)		Total Entrained PM_{10} Emissions (tons/yr)	Total PM10
				Paved	Unpaved														Paved	Unpaved		
LDGV, LDGT, &HDGT	g/VMT	3	N/A	40	10	169	N/A	Travel	0.90	0.03	-	-	8.87	0.25	0.91	0.03	0.11	0.00	0.02	0.78	2.14	
	g/VMT							Cold Start	2.77	0.08	-	-	93.49	2.61	5.21	0.15	-	-	-	-	-	
	g/VMT							Hot Start	1.76	0.05	-	-	12.74	0.36	1.38	0.04	-	-	-	-	-	
	g/VMT							Hot Soak	-	-	-	-	-	-	2.11	0.06	-	-	-	-	-	
	g/VMT							Diurnal	-	-	-	-	-	-	5.01	0.14	-	-	-	-	-	
LDDT	g/VMT	1	N/A	40	10	169	N/A	Travel	12.01	0.11	-	-	11.03	0.10	2.78	0.03	2.63	0.02	0.02	0.78	0.71	
	g/VMT							Cold Start	-	-	-	-	-	-	-	-	-	-	-	-	-	
	g/VMT							Hot Soak	-	-	-	-	-	-	-	-	-	-	-	-	-	
	g/VMT							Diurnal	-	-	-	-	-	-	-	-	-	-	-	-	-	
				TOTAL Emissions in tons/year						**0.264**		**-**		**3.319**		**0.434**		**0.028**			**2.856**	**2.8837**

This page intentionally left blank.

B AIRSPACE MANAGEMENT AND AIR SAFETY

This page intentionally left blank.

B.1 AIRSPACE MANAGEMENT

B.1.1 Edwards AFB, Restricted Area R-2515, and the R-2508 Complex

Since the year 2000 the level of flight activity at AFFTC and Edwards AFB has remained fairly constant. Typically, when a flight test program is completed a new flight test program begins. The number of personnel, vehicles, aircraft, and basic infrastructure needed to support these flight activities is proportionate to the number of sorties flown. The number of sorties associated with operations at Edwards AFB (including NASA-related flights) from 2000 through 2004 have been approximately 10,500 per year (AFFTC 2005) Table B.1-1.

Table B.1-1

Sortie Summary by Aircraft and Year at AFFTC

	Year				
Aircraft Type	**2000**	**2001**	**2002**	**2003**	**2004**
B-1	110	118	135	81	74
B-2	15	44	9	47	36
B-52	47	69	61	70	66
BE-20	0	3	53	28	5
BE-200	50	66	75	49	44
Boeing 737/747/757	14	12	14	46	13
C-5	0	0	3	34	67
C-12	451	483	494	600	602
C-130	106	163	92	84	145
C/KC-135	674	653	784	837	709
C-17	194	139	223	194	221
CH-46	275	266	326	346	76
CH-53	133	227	319	220	62
DC-8	12	19	44	34	16
ER-2	74	95	78	34	19
F-117	391	312	337	274	342
F-15	1,088	920	843	820	596
F-16	3,128	2,706	2,782	3,035	2,978
F-18	624	479	463	349	271
F-22	154	337	565	909	1,021
HH-60G	0	16	80	111	140
KC-10	24	55	65	67	180
T/AT-38	2,773	2,315	1,926	1,894	1,545
X-45/X-47	0	0	7	10	27
Other	915	910	672	522	474
Totals	11,252	10,407	10,450	10,695	9,729

Source: AFFTC 2005

This page intentionally left blank.

B.2 AIRSPACE MANAGEMENT

B.2.1 OVERVIEW

Airspace is defined as the space that lies above a nation and comes under its jurisdiction. Although it is generally viewed as being unlimited, airspace is a finite resource that can be defined vertically and horizontally, as well as temporally, when describing its use for aviation purposes. Under Public Law (P.L.) 85-725, the Federal Aviation Administration (FAA) is charged with the safe and efficient use of the nation's airspace and has therefore established certain criteria and limits for its use. In order to accomplish its task, the FAA utilizes the National Airspace System (NAS).

Part of the NAS includes Special Use Airspace (SUA). SUA consists of airspace wherein activities must be confined because of their nature, or wherein limitations are imposed upon aircraft operations that are not a part of those activities, or both (FAA 2000). Except for controlled firing areas, SUA areas are depicted on aeronautical charts. Generally SUA consist of the following:

- Prohibited Areas— There are no prohibited areas within the region of interest for the alternatives.

- Restricted Areas—These are areas that denote the existence of unusual, often invisible hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles. An aircraft may not enter a restricted area unless permission has been obtained from the controlling agency. Restricted areas are depicted on aeronautical charts and are published in the *Federal Register*.

- Warning Areas—There are no warning areas within the region of interest for the alternatives.

- Military Operation Areas (MOAs)—These are areas that consist of airspace of defined vertical and lateral limits established for the purpose of separating certain military training activities from instrument flight rules (IFR) traffic. There is no restriction against a pilot operating in visual flight rules (VFR) in these areas; however, a pilot should be alert since training activities may include acrobatic and abrupt maneuvers. MOAs are depicted on aeronautical charts.

- Alert Areas—There are no alert areas within the region of interest for the alternatives.

- Controlled Firing Areas (CFAs)—There are no CFAs within the region of interest for the alternatives.

Detailed information on the restricted areas R-2515 and R-2508 SUA are available in the *R-2508 Users Guide*, which can be found at http://r2508.edwards.af.mil/. Armed munitions integration testing will be entirely within SUA restricted areas R-2515 within the R-2508 Complex.

The R-2508 Complex Control Board reported that between 1990 and 2002 approximately 558,300 aircraft flight operations (sorties) (not including helicopter flights) occurred in the R-2508 Complex. From 1990 to 2002 the R-2508 averaged over 42,900 flight operations per year and from 1997 to 2002 averaged over 35,000 flight operations per year. From 1990 to 2002 approximately 233,100 flight operations occurred in restricted area R-2515; averaging approximately 17,900 flight operations per year from 1990 to 2002 and 13,800 flight operations from 1997 to 2002 (AFFTC 2005). In 2005 there were approximately 8,950 aircraft sorties at Edwards AFB (Hagenauer 2006). A listing of annual aircraft sorties by SUA in the R-2508 Complex is shown in Appendix B.1.

B.2.2 ALTERNATIVES A, B, AND C (FLIGHT OPERATIONS IN THE R-2508 COMPLEX, RESTRICTED AREA R-2515, AND EDWARDS AFB)

B.2.2.1 R-2508 Complex

Table B.2-1 gives the name/number, effective altitude, time of use, and controlling agency for the SUA that are included in the R-2508 Complex. Hand-Launched UAVs, M-UAVs, JT-UAVs, and UAV-Es like the Global Hawk, Predator, X-43, X-47A, and Raven currently operate or have been operated in the R-2508, restricted area R-2515, and the airspace above Edwards AFB. There are over 20,000 square miles of airspace in the R-2508 Complex that have been designated as restricted for use by the DoD, National Aeronautics and Space Administration (NASA), and other government agencies. This airspace is over an area 140 miles north to south (Bishop to Edwards AFB) and 110 miles east to west (Nevada state line to Bakersfield). This airspace is scheduled, monitored, regulated, and controlled to provide safe aircraft test areas. Aircraft operational characteristics and altitudes are regulated in this airspace to minimize ground-based conflicts. The R-2508 Complex encompasses large portions of Inyo, Kern, San Bernardino, and Tulare counties in east-central California. It also includes a portion of Fresno and Los Angeles counties in California and extends into Nevada’s Esmeralda County (NASA 1997a).

Table B.2-1

Special Use Airspace of the R-2508 Complex

Number/Name	Effective Altitude (feet)	Time of Use (PST)	Controlling Agency
R-2508 Complex			
R-2502E	Unlimited	Continuous	Hi-Desert TRACON
R-2502N	Unlimited	Continuous	Hi-Desert TRACON
R-2505	Unlimited	Continuous	Hi-Desert TRACON
R-2506	6,000 MSL	0600–1800 M– F[1]	Hi-Desert TRACON
R-2508	FL 200 to Unlimited	Continuous	Hi-Desert TRACON
R-2515	Unlimited	Continuous	Hi-Desert TRACON
R-2524	Unlimited	Continuous	Hi-Desert TRACON
Bakersfield MOA	2,000 AGL–FL 180	0600–1800 M– F[1]	ZLA CNTR
Barstow MOA	200 AGL–FL 180	0600–1800 M– F[1]	Hi-Desert TRACON
Bishop MOA	200 AGL–FL 180	0600–1800 M– F[1]	ZLA CNTR
Buckhorn MOA	200 AGL[2]	0600–1800 M– F[1]	Hi-Desert TRACON
Isabella MOA	200 AGL[2,3]	0600–1800 M– F[1]	Hi-Desert TRACON
Owens MOA	200 AGL–FL 180[3]	0600–1800 M– F[1]	Hi-Desert TRACON
Panamint MOA	200 AGL–FL 180	0600–1800 M– F[1]	Hi-Desert TRACON
Porterville MOA	2,000 AGL–FL 180	0600–1800 M– F[1]	Hi-Desert TRACON
Saline MOA	200 AGL–FL 180	0600–1800 M– F[1]	Hi-Desert TRACON
Shoshone North MOA	200 AGL–FL 180	0600–1800 M– F[1]	ZLA CNTR
Shoshone South MOA	FL 180–FL 600	0600–1800 M– F[1]	ZLA CNTR

Notes: 1-Other times by NOTAM.
2- Up to but not including FL 180.
3- Excluding 3,000 feet AGL and below over Domeland Wilderness Area.
AGL- above ground level
FL- flight level (FL 180 = approximately 18,000 feet above mean sea level)
MOA- Military Operation Area
NOTAM- Notice to Airmen
R- restricted
TRACON- Terminal Radar Control
Source: Federal Aviation Administration (FAA) 2005.

B.2.2.2 Low-Level Test and Training Routes

The R-2508 Complex has unique characteristics that allow the Air Force, Navy, Marine Corps, Army, NASA, and other federal and commercial testing entities to conduct safe, large-scale testing activities for aircraft, spacecraft, and advanced weapon systems. Restricted airspace is established by the FAA to contain or segregate activities that would be hazardous to non-participating aircraft. Military Operating

Areas (MOAs) are defined airspace areas established by FAA to separate/segregate certain military aviation activities from Instrument Flight Rules (IFR) traffic and to identify where these activities are conducted for Visual Flight Rules (VFR) traffic. Within this SUA are Military Training Routes (MTRs) (IFR and VFR), Colored Routes, and Terrain Following Routes (TFRs).

Within the R-2508 Complex there are seven IFR and VFR low-altitude training routes and one slow-speed, low-altitude training route (SR-390). All routes within the ROI that transit the boundaries of the R-2508 Complex are governed by the flight restrictions and requirements to "see and avoid" other aircraft when operating under VFR flight rules. All routes are designated as MARSA operations, which are established by coordinated scheduling. Hours of operation are normally daylight hours. Other hours are by NOTAM, except for Instrument Routes 211 and 212 and VRs 1206, 1206, 1214, 1215, 1217, and 1293, which have continuous hours of operation (National Geospatial-Intelligence Agency 2004).

The eight Colored Routes provide flight corridors for low-level flight tests and training. These Colored Routes are not published on standard aeronautical charts because they are within the SUA of the R-2508 Complex and/or adjacent MOAs. The isolation of the Colored Routes from most civilian air-traffic provides a reduced potential for mid-air collisions with VFR civilian traffic.

The seven TFRs are considered "unpublished" because they are not depicted on standard aeronautical charts used by most pilots and are all located within the R-2515 restricted area and/or the Isabella MOA.

A detailed description of the low-level test and training routes can be found in the *Environmental Assessment for Low-Level Flight Testing, Evaluation, and Training* (Air Force Flight Test Center 2005).

UAV flights for Alternatives A, B, and C would only operate on portions of the routes that lie within their respective ROI.

B.2.2.3 En Route Victor Airways and Jet Routes

There are no en route victor low-altitude (up to but not including 18,000 feet above MSL) airways that transect the airspace within the R-2508 Complex (Figure B.2-2 and B.2-4). The J110 jet route transects the northern one-third of the R-2508 Complex; however this jet route is normally unavailable during daylight hours Monday through Friday.

B.2.2.4 Airports

There are several public-use civilian airports within the R-2508 Complex ROI. These include Borax, Boron, California City Municipal, Death Valley, Goldstone/GTS Private, Independence, Inyokern, Kern

Valley, Lone Pine, Mojave, Mountain Valley, Rosamond Skypark, Shoshone, Stove Pipe Wells, Tehachapi Municipal, and Trona (AFFTC 1997). Edwards AFB runways (including lakebed runways) and Naval Air Weapons Station (NAWS) China Lake/Armitage Field are the only military airfields (National Aeronautical Charting Office [NACO] 2004a) located in the R-2508 Complex (Figure B.2-5).

B.2.2.5 Air Traffic Control

The R-2508 Complex lies exclusively within the Los Angeles ARTCC's boundaries (NACO 2004a). The controlling agency for the SUA within R-2508 Complex is Hi-Desert TRACON. During the published hours of use (identified in Table 3-6), the using agency is responsible for controlling all military activity within the SUA and ensuring that its perimeters are not violated. When the airspace is scheduled to be inactive, the using agency releases it back to the controlling agency (Hi-Desert TRACON), and in effect, the airspace is no longer restricted. If no activity is scheduled during some of the published hours of use, the using agency releases the airspace to the controlling agency for non-military operations for that period of inactivity (Illman 1993).

B.2.2.6 Supersonic Corridors

Currently there are three supersonic corridors within the R-2508 Complex that cross or are contained within restricted area R-2515; the Alpha/PIRA Supersonic Corridor, the Black Mountain Supersonic Corridor, and the High Altitude Supersonic Corridor. The minimum altitude for flight operations in the Alpha Corridor/PIRA supersonic area and Black Mountain supersonic corridor is 500 feet AGL. The Alpha Corridor/PIRA supersonic area is 20 NM long and 4 NM wide; the Black Mountain Supersonic Corridor ranges from 38 to 48 NM long and 8 miles wide except for a semicircular area for maneuvers that extends the width to 12 NM. Currently the minimum altitude for aircraft to use the High Altitude Supersonic Corridor is from 30,000 feet above MSL to unlimited altitude. The High Altitude Supersonic Corridor is 224 NM long and 15 NM wide. From 1980 to 1999 there were approximately 607 supersonic flights annually that operated in the supersonic corridors and work areas at Edwards AFB and the R-2508 Complex (AFFTC 2001). Figure B.2-1 shows the supersonic corridors in the R-2508 Complex.

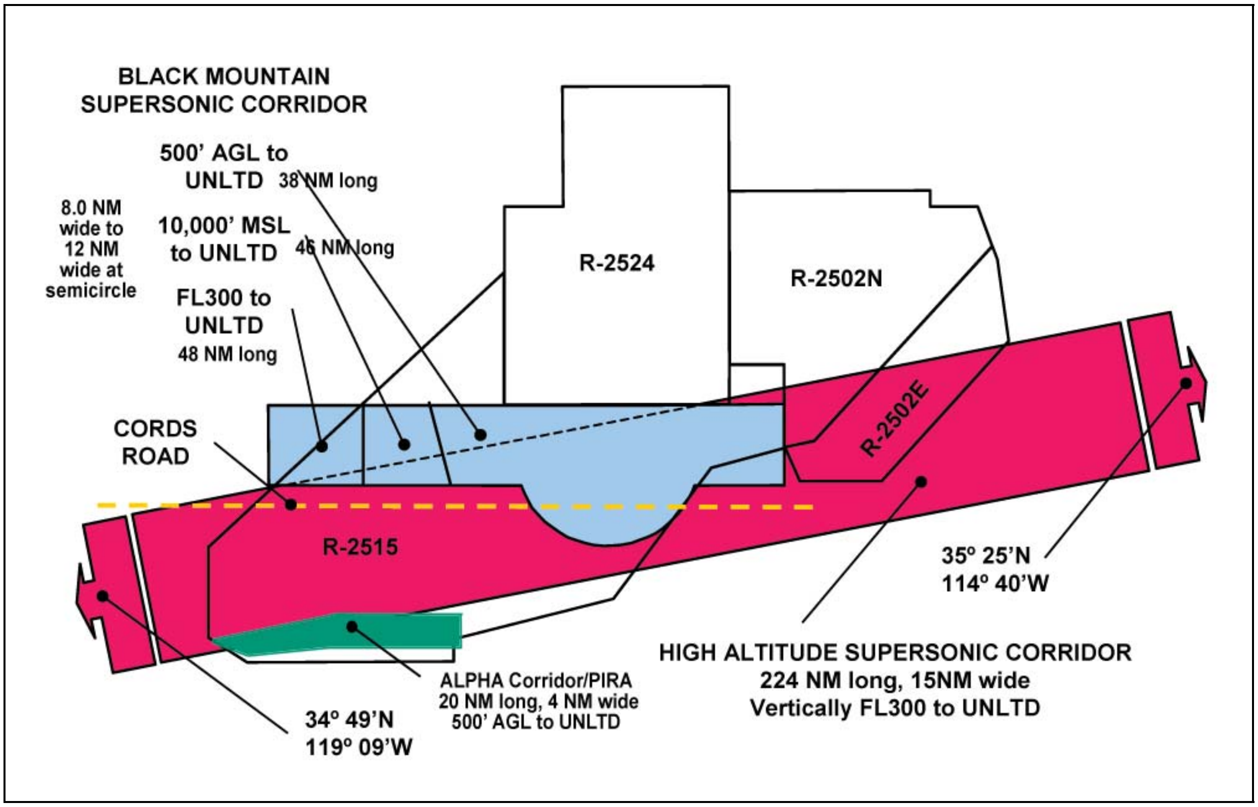


Figure B.2-1

Supersonic Corridors in the R-2508 Complex

B.2.2.3 Restricted Area R-2515 and Edwards AFB

Table B.2-2 gives the name/number, effective altitude, time of use, and the controlling agency for the special use airspace within restricted area R-2515 and the surrounding area.

Table B.2-2

Special Use Airspace In and Surrounding R-2515 and Edwards AFB

Number/Name	Effective Altitude (feet)	Time of Use	Controlling Agency
R-2508 COMPLEX			
R-2508	FL 200 to Unlimited	Continuous	HI-DESERT TRACON
R-2515	Unlimited	Continuous	HI-DESERT TRACON
Buckhorn MOA	200 AGL[b]	0600–2200[a] M–F	HI-DESERT TRACON
Isabella MOA	200 AGL[b,c]	0600–2200[a] M–F	HI-DESERT TRACON
Panamint MOA	200 AGL[b]	0600–2200[a] M–F	HI-DESERT TRACON

Notes: a-Other times by NOTAM.

b- Up to but not including FL 180.

c- Excluding 3,000 feet AGL and below over Domeland Wilderness Area.
AGL- above ground level
FL- flight level (FL 180 = approximately 18,000 feet above mean sea level)
MOA- Military Operation Area
NOTAM- Notice to Airmen
R- restricted
TRACON- Terminal Radar Control

Source: National Aeronautical Charting Office 2004a, b, and c.

There are 1,575 square miles of airspace that have been designated as restricted for use by DoD, National Aeronautics and Space Administration (NASA), and other government agencies. This airspace is over a remote area 40 to 60 miles north of Los Angeles, California. Known by its FAA designation as the R-2515, this airspace is scheduled, monitored, regulated, and controlled to provide safe aircraft test areas. Aircraft operation characteristics and altitudes are regulated in this airspace to minimize ground-based conflicts, which are primarily due to noise. The R-2515 complex encompasses portions of Kern, San Bernardino, and Los Angeles counties in east central California (NASA 1999).

Special use airspace within Alternatives A and B includes the restricted area R-2515 over Edwards AFB. The Buckhorn, Panamint, and Isabella MOAs surround the R-2515 restricted area. There are no warning, prohibited, or alert special use airspace areas within Alternatives A, B, and C (National Geospatial-Intelligence Agency 2004).

Military Training Routes

Alternatives A, B, and C contain one IR (IR-236), one Visual Route (VR) low-altitude military training route (VR-1293), and one slow-speed, low-altitude training route (SR-390) (Figure B.2-3). All routes within the ROI that transit the boundaries of the R-2515 are governed by the flight restrictions and requirements to “see and avoid” other aircraft when operating under VFR. All routes are designated as “military assumes responsibility for separation of aircraft” (MARSA) operations, which are established by coordinated scheduling. Hours of operation are continuous except for IR-236, which operates daily from 0600 to 2200 hours local time (National Geospatial Intelligence Agency 2004).

En Route Victor Airways and Jet Routes

There are no en route victor low-altitude (up to but not including 18,000 feet above MSL) airways or high-altitude jet routes that transect the airspace within Alternatives A, B, or C (Figures B.2-2 and B.2-4).

Airports/Airstrips

There are several airports/airstrips within the ROI for Alternatives A, B, and C. These include Edwards AF Aux North Base, Borax Private, and Edwards AFB (Figures B.2-4 and B.2-5).

Air Traffic Control

Alternatives A, B, and C lie exclusively within the Los Angeles Air Route Traffic Control Center's (ARTCC's) boundaries (National Aeronautical Charting Office [NACO] 2004 a, b, and c). The controlling agency for the Restricted Areas and MOAs within the R-2515 is TRACON. During the published hours of use (identified in Table B.2-1), the using agency is responsible for controlling all military activity within the special use airspace and ensuring that its perimeters are not violated. When scheduled to be inactive the using agency releases the airspace back to the controlling agency (Los Angeles ARTCC), and in effect, the airspace is no longer restricted. If no activity is scheduled during some of the published hours of use, the using agency releases the airspace to the controlling agency for non-military operations for that period of inactivity (Illman 1993).

LEGEND

0 10 20 30

SCALE IN NAUTICAL MILES

Note: Airports shown have a minimum of 5,000 feet of hard surface runway. Airports and airfields in blue and green have published approaches.

J5 Jet Routes

Special Use Airspace and Warning Areas

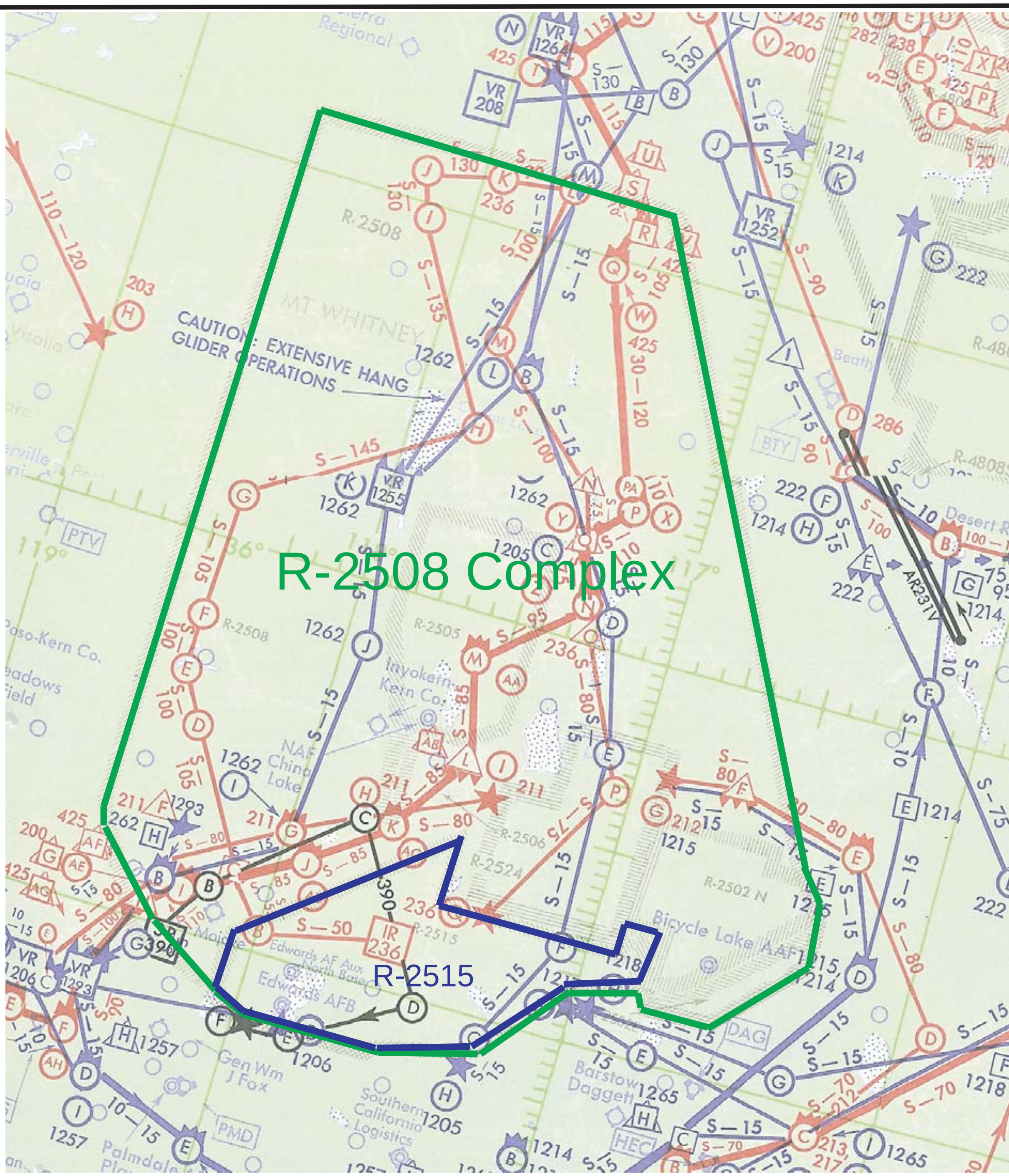
Civilian Airport (Blue, Green, Brown)

Military Airfields (Blue, Green)

Environmental Assessment for the Routine and Recurring Unmanned Aerial Vehicle Flight Operations at Edwards AFB

SPECIAL USE AIRSPACE, JET ROUTES, AND AIRPORTS UNDER ALTERNATIVES A, B, and C

DATE	FILE NO.	FIGURE NO.
6/12/06	Q267-05/fig/b.2-2.pdf	B.2-2



LEGEND

Special Use Airspace in the R-2508 Complex	
R-2515	Civilian Airport
R-2508 Complex	Military Airfields
	Instrument Route (IR) Military Training Route
	Visual Route (VR) Military Training Route
	Slow Route (SR) Military Training Route

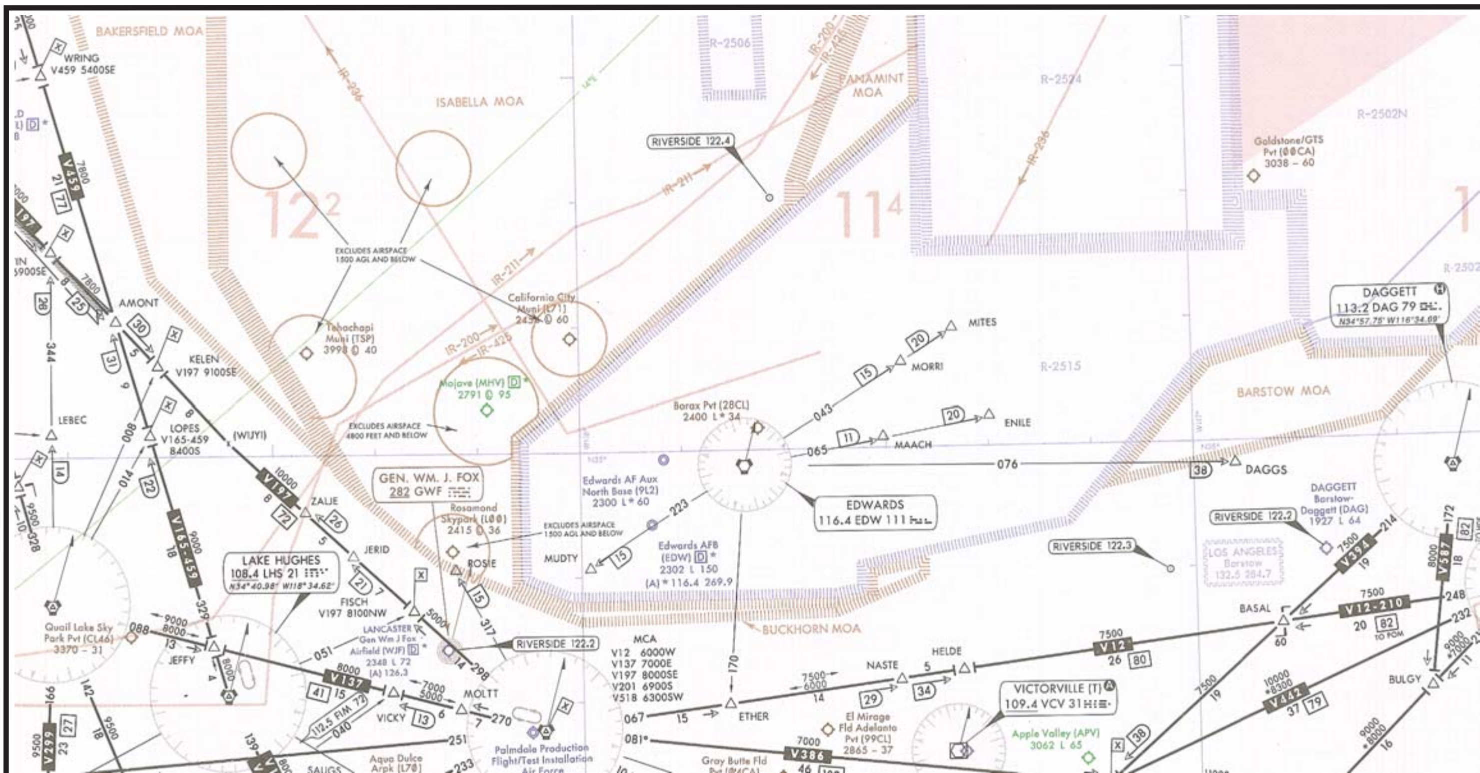
0 15 30

SCALE IN NAUTICAL MILES

EA for the Routine and Recurring Unmanned Aerial Vehicle Flight Operations at Edwards Air Force Base, California

SPECIAL USE AIRSPACE, MILITARY TRAINING ROUTES, AND AIRPORTS

TASK NO.	DATE	FILE NO.	FIGURE NO.
Q267-05	6/12/06	Q267-05/fig/b.2-3	B.2-3



LEGEND

0 10 20 30

SCALE IN NAUTICAL MILES

V32 Victor Routes

Civilian Airport

Military Airfields

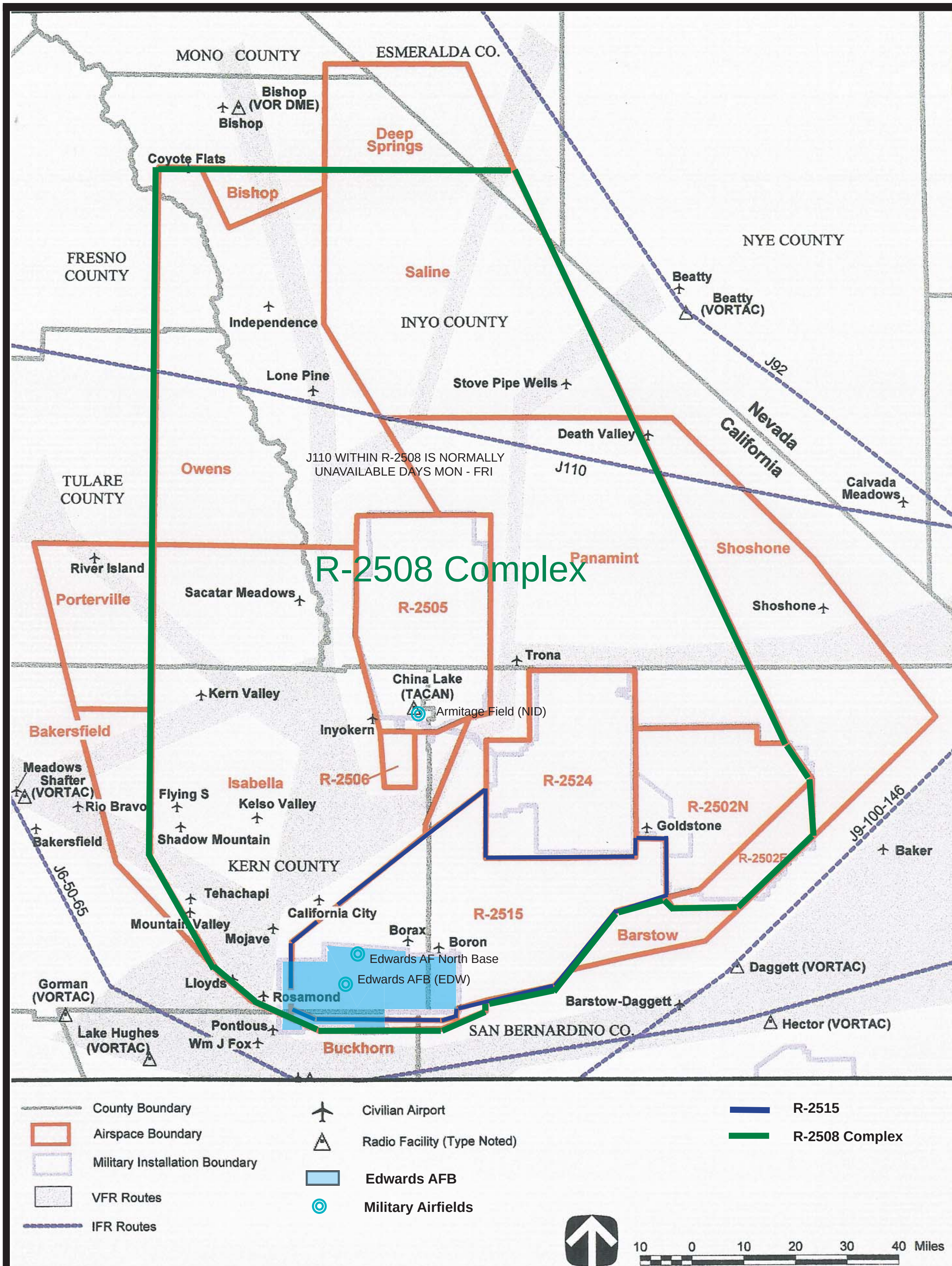
Special Use Air Space and Warning Areas

Military Operating Areas

Environmental Assessment for the Routine and Recurring UAV Flight Operations at Edwards AFB

SPECIAL USE AIRSPACE, VICTOR ENROUTE AIRWAYS, AND AIRPORTS UNDER ALTERNATIVES A, B, and C

DATE	FILE NO.	FIGURE NO.
6/12/06	Q267-05/fig/b.2-4.pdf	B.2-4



Airports and Airstrips in the R-2508 Complex	Q267-05	B.2-5	6/12/06

TABLE 31

TOTAL COMBINED AIRCRAFT OPERATIONS AT AIRPORTS

WITH FAA AND CONTRACT TRAFFIC CONTROL SERVICE

(In Thousands)

FISCAL	AIR	AIR TAXI/	GENERAL AVIATION			MILITARY				NUMBER OF TOWERS	
YEAR	CARRIER	COMMUTER	ITINERANT	LOCAL	TOTAL	ITINERANT	LOCAL	TOTAL	TOTAL	FAA	CONTRACT
Historical*											
2000	15,158.7	10,760.6	22,844.1	17,034.4	39,878.5	1,422.0	1,448.2	2,870.2	68,668.0	288	165
2001	14,762.8	10,882.1	21,433.3	16,193.7	37,627.0	1,493.0	1,437.6	2,930.6	66,202.5	288	192
2002	13,209.7	11,029.4	21,450.5	16,172.8	37,623.2	1,552.5	1,511.0	3,063.5	64,925.9	266	206
2003	12,823.9	11,426.0	20,231.3	15,292.1	35,523.5	1,528.7	1,480.5	3,009.2	62,782.5	266	217
2004	12,934.0	12,243.9	20,007.2	14,960.4	34,967.6	1,498.8	1,480.5	2,979.3	63,124.8	266	228
2005E	13,531.4	12,571.9	19,284.1	14,817.8	34,101.9	1,405.5	1,448.0	2,853.5	63,058.7	266	234
Forecast											
2006	13,396.1	12,454.2	19,064.2	15,010.0	34,074.2	1,414.0	1,449.1	2,863.1	62,787.6	266	241
2007	13,797.2	12,794.2	19,520.5	15,492.0	35,012.5	1,431.1	1,451.3	2,882.3	64,486.3	266	241
2008	14,146.8	13,114.1	19,866.6	15,647.0	35,513.6	1,431.1	1,451.3	2,882.3	65,656.7	266	241
2009	14,515.5	13,455.0	20,345.4	15,866.0	36,211.5	1,431.1	1,451.3	2,882.3	67,064.3	266	241
2010	14,882.4	13,804.9	20,874.8	16,119.9	36,994.7	1,431.1	1,451.3	2,882.3	68,564.3	266	241
2011	15,264.1	14,177.6	21,427.1	16,393.9	37,821.1	1,431.1	1,451.3	2,882.3	70,145.1	266	241
2012	15,668.8	14,560.4	21,971.3	16,705.4	38,676.7	1,431.1	1,451.3	2,882.3	71,788.2	266	241
2013	16,086.3	14,953.5	22,474.9	17,039.5	39,514.4	1,431.1	1,451.3	2,882.3	73,436.6	266	241
2014	16,531.3	15,372.2	22,960.3	17,380.3	40,340.6	1,431.1	1,451.3	2,882.3	75,126.4	266	241
2015	16,993.2	15,802.6	23,422.4	17,727.9	41,150.3	1,431.1	1,451.3	2,882.3	76,828.4	266	241
2016	17,482.6	16,245.1	23,863.2	18,082.5	41,945.7	1,431.1	1,451.3	2,882.3	78,555.7	266	241
2017	18,003.0	16,683.7	24,295.8	18,444.1	42,739.9	1,431.1	1,451.3	2,882.3	80,309.0	266	241
Avg Annual Growth 2005-2017	2.4%	2.4%	1.9%	1.8%	1.9%	0.2%	0.0%	0.1%	2.0%		

* Source: FAA Air Traffic Activity.

Chapter 2

2.0 General Operating Procedures for R-2508 Complex

This chapter discusses general operating procedures relating to all work areas, including:

2.1 General Complex Information

2.2 The Scheduling Process

2.3 Complex Scheduling Agencies

2.4 Special Activities

2.5 Scheduling Special Operations

2.6 Scheduling Large-Scale Exercises

2.7 Operating Remotely Operated Aircraft (ROA)

2.8 Flight Planning Requirements

2.1 General Complex Information

The Joint Policy and Planning Board (JPPB) is chartered by DoD to act as the overarching and policy body for the R-2508 Complex. All JPPB sponsored units operating within the R-2508 complex **shall receive an annual face-to-face R-2508 Complex briefing** on Complex Operations and Procedures from the R-2508 Central Coordinating Facility (CCF) or their sponsoring JPPB Commander (e.g. Navy/Marine Corps units are sponsored by the Commander, NAWCWD). The R-2508 brief will address scheduling procedures; safety concerns, and overflight sensitivities. Annual briefings are normally conducted in January and February each year. Additionally, CCF provides airspace briefings for special/large scale operations on an as needed basis.

****Commanders of units flying in the R-2508 Complex are responsible for ensuring their aircrews are briefed annually on R-2508 Complex procedures****

- Users include participating aircraft transiting the airspace to installations located within the R-2508 Complex.
- Civilian aircrews operating under an R-2508 Complex Letter of Agreement (LOA) are required to comply with the briefing requirements and operating procedures defined herein, except as modified by the terms of the LOA.
- Any JPPB sponsored unit that hosts a transient unit will be responsible for that transient unit's compliance with R-2508 Complex operations and Procedures.
- Only JPPB sponsored activities that have received the annual R-2508 Complex brief will be allowed to schedule missions in the complex

The R-2508 Complex is comprised of Military Operations Areas (**MOA**s) and Air Traffic Control Assigned Airspace (**ATCAA**s).

MOAs: The four main MOA work areas—Isabella, Owens, Saline, and Panamint—have a minimum altitude boundary of 200 feet AGL (see Figure 2-1).

- MOAs **DO NOT** include airspace below 1,500 feet AGL within 3 miles of any charted airport, except for Mojave Airport's Class D airspace (4,800 feet MSL within a 5 NM radius, excluding the airspace east and parallel to a line ½ mile west of R-2515).
- **Portions of these major work areas are located over Sequoia/Kings Canyon National Parks, John Muir and Domeland Wilderness Areas, and Death Valley National Park, (see Figures 7-4 & 7-5) where the lower limit of the MOA is 3,000 feet AGL.**

NOTE: Exclusion of MOA airspace about the Death Valley National Park and Domeland Wilderness Area applies to the 1977 contours of the former National Monument and Wilderness Area. This difference in affected airspace may not be accurately reflected in Sectional Charts. Refer to Figures 7-4 & 7-5 in Section 7.0 and contact CCF for more information.

CAUTION! ***The Owens MOA does not include the airspace that is designated as Bishop MOA (Figures 2-1 and 2-2). Aircrews must be aware of this boundary difference to prevent spillouts into Oakland Air Route Traffic Control Center (ARTCC) airspace.***

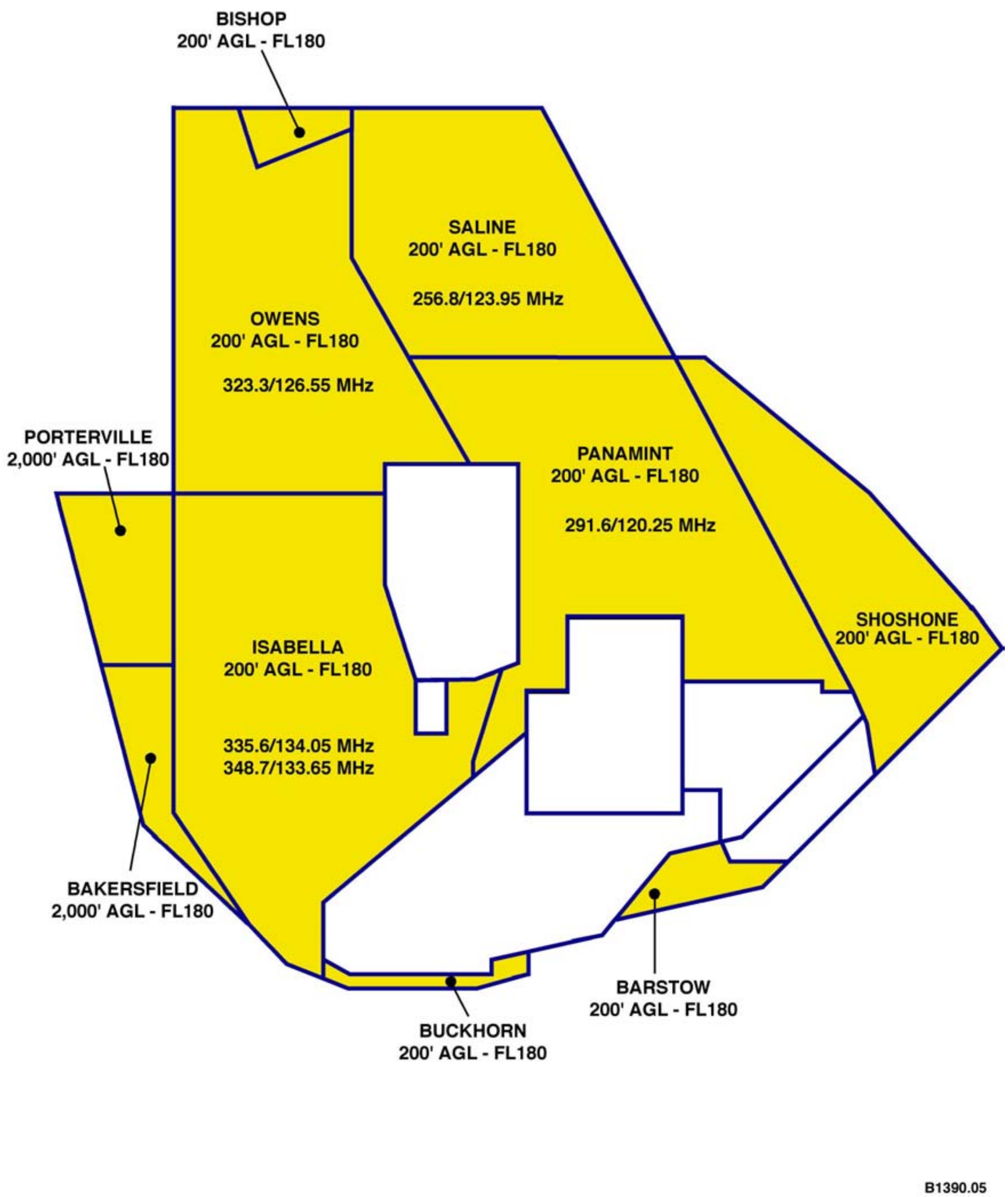


Figure 2-1. *Military Operations Areas (**MOAs**).*

ATCAAs: The ATCAAs (Figure 2-2) are used to fill the airspace gap between the top of the MOAs (FL180) and the base of R-2508 (FL200). When R-2508 is not activated, the ATCAAs may extend upward to FL600. ATCAAs are also located above the peripheral MOAs, outside the lateral boundaries of R-2508, to provide additional work areas up to FL600 for segregation of military operations from IFR traffic.

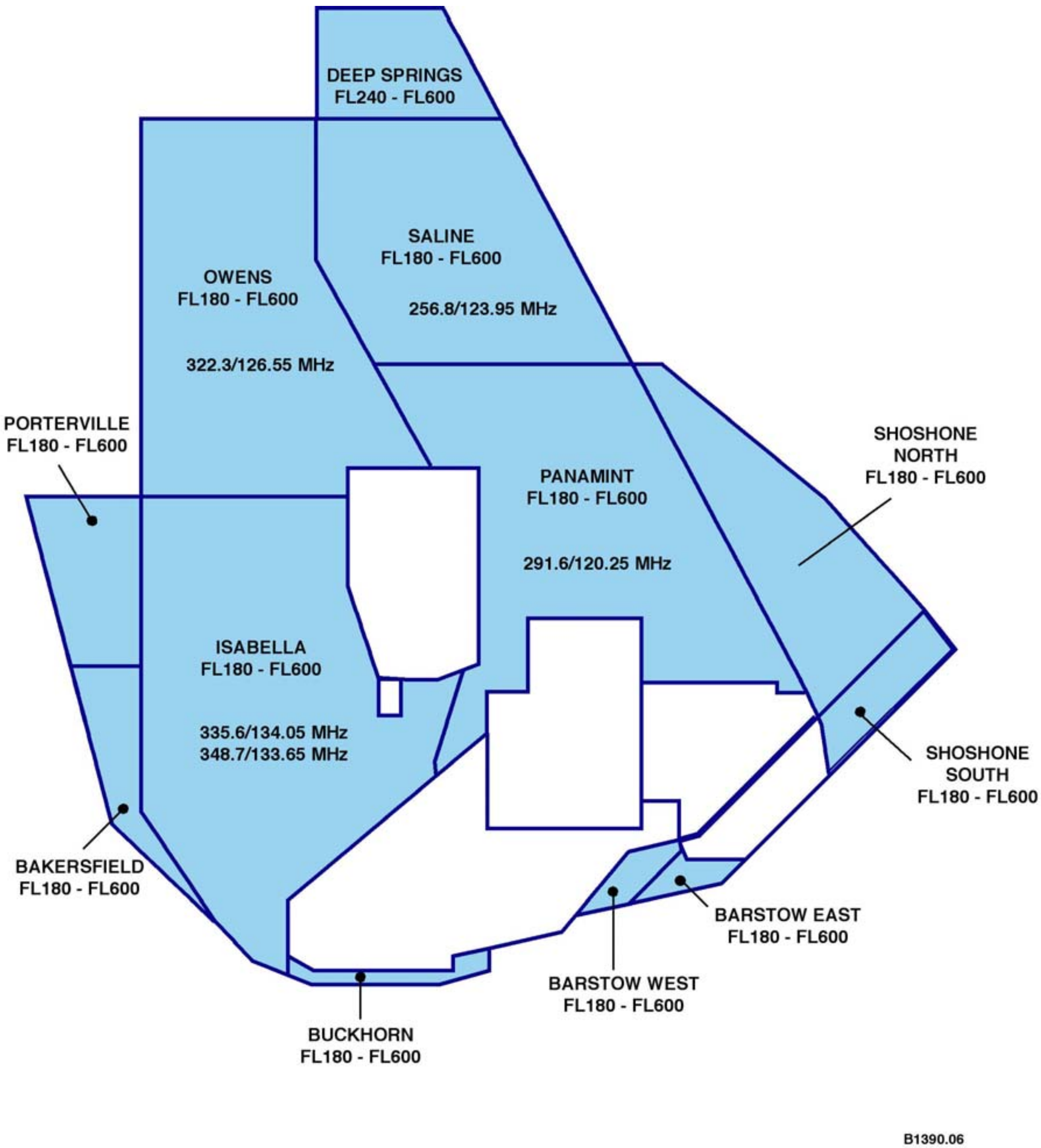


Figure 2-2. *Air Traffic Control Assigned Airspace (**ATCAAs**).*

2.2 The Scheduling Process

R-2508 Complex scheduling requirements apply to all Complex flight activities, including special operations and large-scale exercises.

CCF is the designated airspace management and scheduling authority for the R-2508 Restricted Area, Military Operations Areas (MOAs), and Air Traffic Control Assigned Airspace (ATCAAs). CCF coordinates mission requirements of all R-2508 Complex users to ensure optimum airspace utilization and safety.

NOTE*: Military units requiring use of R-2508 Complex airspace must comply with scheduling requirements established in OPNAVINST 3710.7, AFI 13-201, U.S. Army AR 95-50, FLIP, and this Handbook.*

2.2.1 Airspace Scheduling

Airspace is either activated for military use or released for joint use.

When R-2508 Complex airspace is activated for military use, it is reserved as **scheduled**. When Complex airspace is not scheduled, it is released to the Federal Aviation Administration (FAA) for **Joint-Use**.

When scheduling airspace:

- **Request only those areas and altitudes necessary for mission completion.** Additional areas and altitudes may be requested in flight, if required, contingent upon the status of the airspace (activated for military use or released for joint use).
- **CCF must have 2 hours notice to reactivate MOA/ATCAA airspace.** JOSHUA (FAA) will NOT issue a work area clearance when airspace is released for joint use.
- **Schedule any weekend and holiday operations through CCF during normal CCF operating hours, M-F 0600-1800 Local** (excluding Federal holidays) **at 661-277-2508 DSN 527-2508.**
- **Outside normal working hours, changes to *previously scheduled* events shall be coordinated with the CCF duty airspace manager at: 1-866-805-2851.**
- **Changes in Area that require activation of additional airspace must be made at least 2 hours in advance to activate the airspace.**

NOTE: TRACON is NOT authorized to schedule or activate any unscheduled R-2508 Complex airspace.

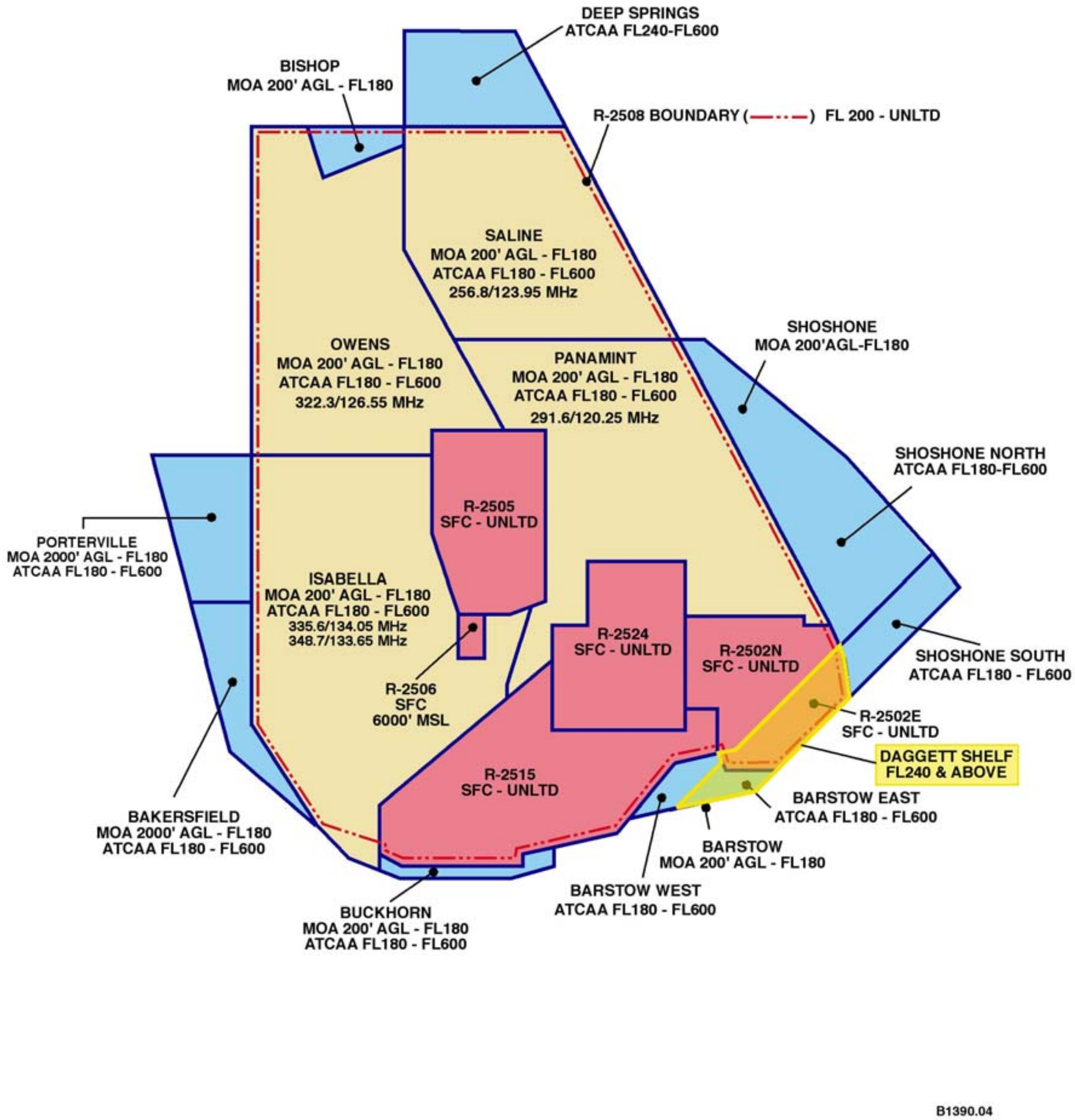


Figure 2-3*. Overview of R-2508 Complex Airspace.*

2.2.2 Aircraft Scheduling

To schedule aircraft in the R-2508 Complex:

1. **Submit the R-2508 Complex Airspace Request Form to CCF by 1700(local) one working day prior to the date of intended use.**
2. **Submit the R-2508 Complex Airspace Request Form for weekend or holiday period events to CCF by 1700(local), the Friday before.**
   - **If the flight schedule is late, airspace/work areas may not be available due to the release of Complex airspace for joint use.**

Information shall include:

- Aircraft Call Sign
- Number and Type aircraft
- Estimated time of entry (in ZULU) into Complex airspace
- Estimated delay within Complex airspace (1+00, 1+30 etc.)
- Altitudes (highest altitude required for mission)
- Departure/Arrival airport
- Requested and/or approved airspace. Indicate work areas (MOAs/ATCAAs) **and** any internal restricted areas.
  - *Aircrews are responsible for scheduling any Internal Restricted areas with the appropriate agency.*
- Remarks
  - Type mission/activity to be conducted
  - Mission frequency, if required
  - Any MTRs, low-level or navigation routes that affect R-2508 Complex airspace. (Aircrews are responsible to schedule any route of intended use with the appropriate route scheduling agency)
  - ANY special activities (e.g., NVG/NVD, ECM, Tanking, “Lights out,” etc.)

Call Signs

Call signs provided to CCF for activities in the R-2508 Complex shall not exceed 7 characters/numbers and shall be the same as filed on a DD-175. Two-letter abbreviated call signs, such as BH-1 for “Bloodhound 01,” will be interpreted and broadcast as “BRAVO HOTEL 01” by Air Traffic Control (ATC). Tactical call signs shall not exceed 7 characters/numbers and shall be a pronounceable word, in accordance with *DoD FLIP, General Planning (GP), Flight Plans.*

Additions, Changes, and Cancellations

Any add-ons, call sign changes, or time slips of more than 1/2 hour before or 1 hour after the proposed time of Complex entry, NOT coordinated with CCF, are considered unscheduled events.

- If changing ***previously scheduled*** events after CCFs normal working hours (0600-1800 M-F) contact CCF duty Airspace Manager at: 1-866-805-2851.
- Changes in area that requires activation of additional airspace must be made at least 2 hours prior to activate the airspace.
  - **Notification of cancellations is required to ensure proper management and release of Complex airspace for joint use.**

2.2.3 Policy for Unscheduled Aircraft

For unscheduled aircraft, the following procedures are enforced:

1. **Fixed-wing units failing to comply with scheduling policies shall be restricted from entry/operating within R-2508 Complex airspace.**
2. IFR aircraft may encounter extensive delays or may be denied access when requesting to transit the R-2508 Complex if they are not participating aircraft.

2.2.4 Transitioning Participating Aircraft

Participating aircraft that have filed a flight plan to land at Naval Air Weapons Station (NAWS) China Lake or Edwards Air Force Base **must schedule with CCF**.

- **Failure to do so may cause the aircraft to be considered as unscheduled.**

2.3 Complex Scheduling Agencies

Units planning operations in R-2508 Complex airspace should be prepared to coordinate and schedule through one or more of the following agencies that have scheduling and operational control.

Area	Agency	Hours of Operation	Function	Contact Numbers
R-2508, MOAs & ATCAAs	R-2508 Central Coordinating Facility (CCF)	0600–1800 M-F	Complex Management, User / Pilot Briefings, Airspace Scheduling	DSN 527-2508 (661) 277-2508 Fax: DSN 527-4798 (661) 277-4798 Mobile: 1-866-805-2851
			E-mail: **2508CCF@edwards.af.mil**	
R-2502N / R-2502E	NTC Fort Irwin	24 hours a day	Scheduling	DSN 470-4320 / 6816 (760) 380-4320 / 6816 Fax: DSN 470-6368 (760) 380-6368
		0800–1600 M-F	Installation Aviation Officer	DSN 470-4072 / 4167 (760) 380-4072 / 4167 Fax: DSN 470-6368 (760) 380-6368
R-2505 / R-2506	NAWCWD China Lake	0700–1700 M-TH 0700–1600 Non-civilian payday Fridays	COSO Range Scheduling	DSN 437-6800 (760) 939-6800 Fax: DSN 437-6950 (760) 939-6950
			Test Management Office	DSN 437-6807 (760) 939-6807 Fax: DSN 437-6950 (760) 939-6950
			Airspace Surveillance Center (ASC) “China Control”	DSN 437-6908 / 6909 (760) 939-6908 / 6909 Fax: DSN 437-6855 (760) 939-6855
R-2515	Edwards AFB	0600–1700 M-F	Resource Operations Center	DSN 527-3940 / 4110 (661) 277-3940 / 4110 Fax: DSN 527-9685 (661) 277-9685
R-2515	Edwards AFB	0600–1530 M-F	Airspace Management Office	DSN 527-2446/ 4453 (661) 277-2446 / 4453 Fax: DSN 527-4462/5544 (661) 277-4462/5544

Area	Agency	Hours of Operation	Function	Contact Numbers
R-2524*	NAWCWD China Lake	0630–1630 M-TH	Echo Range (ECR) Scheduling	DSN 437-9128 / 9131 (760) 939-9128 / 9131 Fax: DSN 437-9152 (760) 939-9152
			Test Management Office	DSN 437-9149 (760) 939-9149
Superior Valley	NAWCWD China Lake	0630–1630 M-TH	Range Manager	DSN 437-9434 (760) 939-9434 Fax: DSN 437-9152 (760) 939-9152

R-2524 <u>does not</u> schedule Superior Valley Tactical Training Range.

2.4 Special Activities

Special activities are defined as operations involving one or more of the following:

- Aerial refueling
- Anchoring/Holding pattern requirements
- Air intercept/Air Combat Maneuvering (ACM) activities (5 to 10 aircraft)
- Escorted Remotely Operated Aircraft (ROA) or missile flights
- Ground control intercept (GCI) activities
- A concentration or continuous flow of aircraft
- Electronic Counter Measures (ECM) (jamming/chaff corridors; not self-protection)
- Airborne Radar Unit (ARU)/Communications link
- Tow Operations

Requests for special activities must be submitted with at least 7 working days lead time to allow all necessary coordination/changes to be approved by at least 48 hours prior to the scheduled operation.

- Lead times and approval requirements are required to allow other units to be briefed on the operation (times, routes, altitudes, activities, etc.) and deconflict the proposed operation from other activities within the Complex.
- **Appendix C: Mission Planning Checklist**, is designed to be provided to CCF in order to simplify coordination of Special Activities for missions involving 10 or fewer aircraft.

CCF has the authority to designate refueling areas, ACM areas, entry/exit routes, etc., and will coordinate the proposed operation to minimize impact on other Complex users while retaining scenario realism. Final approval authority rests with the CCB.

2.5 Scheduling Special Activities

This section discusses the following special activities that are carried out within the Complex that may affect where and how other missions are flown within the Complex:

2.5.1 "Lights Out" Operations

2.5.2 Electronic Counter Measures/Chaff

2.5.3 Flares

2.5.4 Aerial Refueling

2.5.5 Supersonic Operations

2.5.6 Airborne Radar Unit (ARU)/Airborne Warning and Control Systems (AWACS) Operations

2.5.7 Tow Operations

2.5.1 "Lights Out" Operations

"Lights out" operations are allowed **ONLY within these internal restricted areas: R-2505, R-2524, R-2502N, and R-2502E**.

"Lights out" operations are NOT authorized in any other special-use airspace, including R-2508.

Units that require "lights out" operations shall contact the appropriate scheduling agency for the internal restricted area listed in Section 2.3.

- Aircrews shall advise the controlling agency when commencing and terminating "lights out" operations.
- Aircrews shall leave aircraft position lights ON while transiting to and from the scheduled restricted area. Turn lights OFF only when authorized within the internal restricted area.

A waiver to FAR 91.209 is unnecessary if the aircraft is operating in a restricted area in compliance with the using/scheduling agency's rules of operation for that internal restricted area.

2.5.2 Electronic Counter Measures/Chaff

For activities using electronic counter measures (ECM) (jamming and/or chaff) in the R-2508 Complex, you must pre-coordinate with and obtain approval from appropriate Base

Spectrum Managers. Users must also inform CCF about these activities during the scheduling process.

Spectrum Managers	DSN	Commercial
WAFC, Pt. Mugu	351-7983	(805) 989-7983
AFFTC, Edwards AFB	527-2390	(661) 277-2390
NAWCWD, China Lake	437-6827	(760) 939-6827
National Training Center, Fort Irwin	470-3280	(760) 380-3280

2.5.3 Flares

Flare use is limited to internal restricted areas only and **IS NOT** authorized in R-2508 restricted area, MOA, or ATCAA airspace. Flare use must be coordinated with the appropriate restricted area's scheduling agency.

2.5.4 Refueling Areas

The R-2508 Complex has three *unpublished* refueling areas (see Figure 2-4). These areas are available for use and must be scheduled with the Edwards AFB Resource Operations Center or CCF.

Refueling area definitions:

Area	Entry	Outbound	Latitude	Longitude	Frequency
Isabella	PMD 345°/ 35	PMD 345R, left turns	35°13'N	118°04'30"W	234.825 MHz
Coaldale	OAL 155°/ 60	OAL 155R, left turns	37°00'N	117°33'W	252.175 MHz
Shoshone	BTY 150°/ 60	BTY 150R, left turns	35°50'N	116°26'W	272.175 MHz

Cautions and Warnings!

For pilots operating in the vicinity of R-2508 Complex Refueling areas:

1. **Always use the "See-and-Avoid" principle throughout your refueling operations.**
2. Tanker areas are **NOT exclusive-use airspace** and are **NOT protected** from other Complex aircraft operating in the area.
3. **If you see a tanker formation that is not part of your operation, avoid the formation by at least 2,000 feet vertically and 5 miles horizontally.** This distance is used to reduce the risk of incident due to emergency breakaways or maneuvers by the tanker formation.
4. Request the status of refueling areas from High Desert TRACON (JOSHUA).
5. No radar coverage is available below 10,000 feet mean sea level (MSL) for the Shoshone and Coaldale refueling areas.

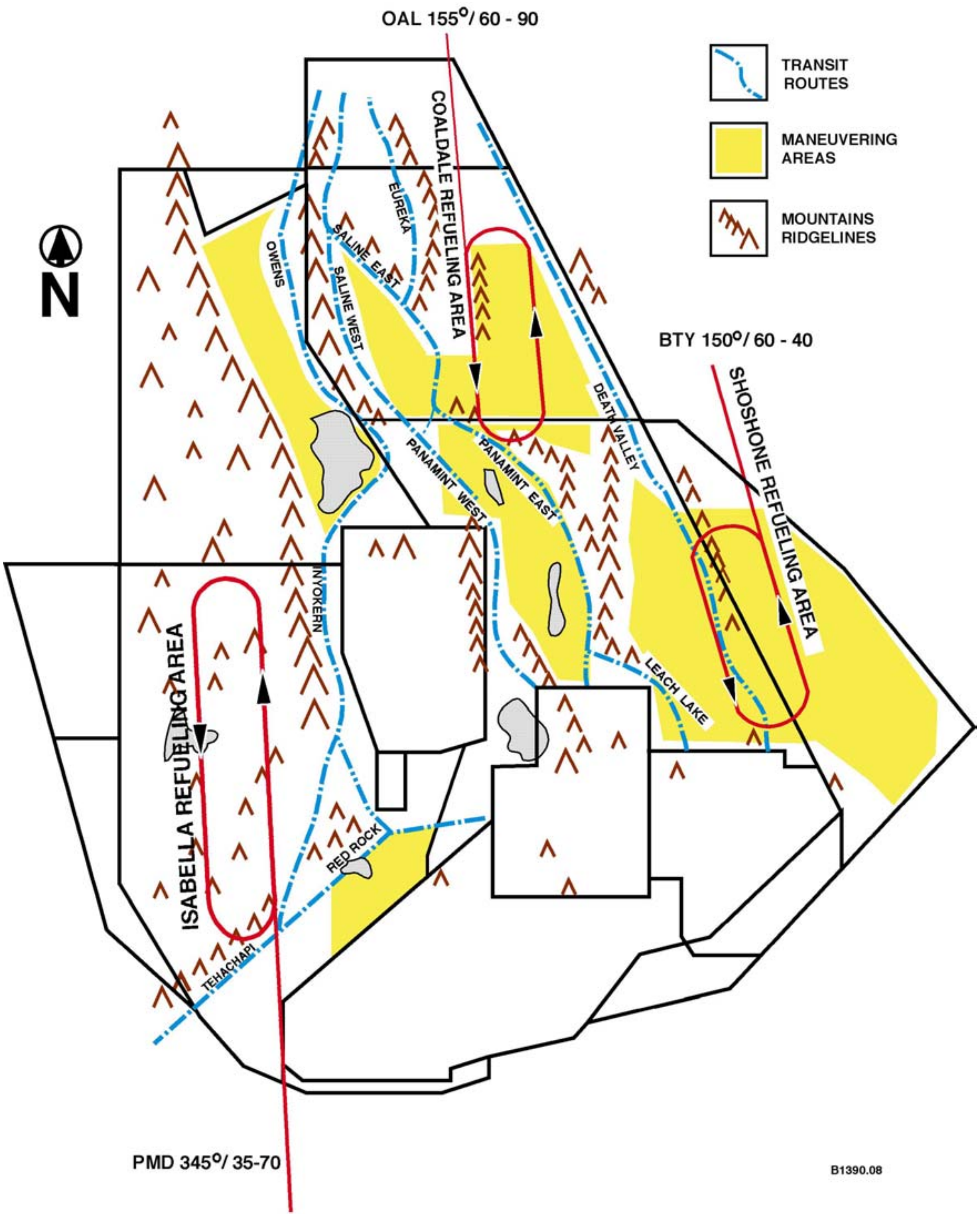


Figure 2-4. *Refueling and Maneuvering Area's and Transit Routes in the R-2508 Complex.*

2.5.5 Supersonic Operations

Supersonic flight is authorized in the R-2515 High-Altitude and Black Mountain supersonic corridors (see Figure 2-5) when properly scheduled.

Supersonic flight is NOT normally authorized in R-2508, MOAs, or ATCAAs. CCB approval is required in advance.

Supersonic operations can be conducted in other internal restricted areas after receiving specific approval from the appropriate scheduling agency.

To schedule the supersonic corridors, contact the Edwards Resource Operations Center at DSN: 527-3940 / 4110.

All supersonic flight must be reported as directed by appropriate military service directives (OPNAVINST 3710.7, AFI 13-201).

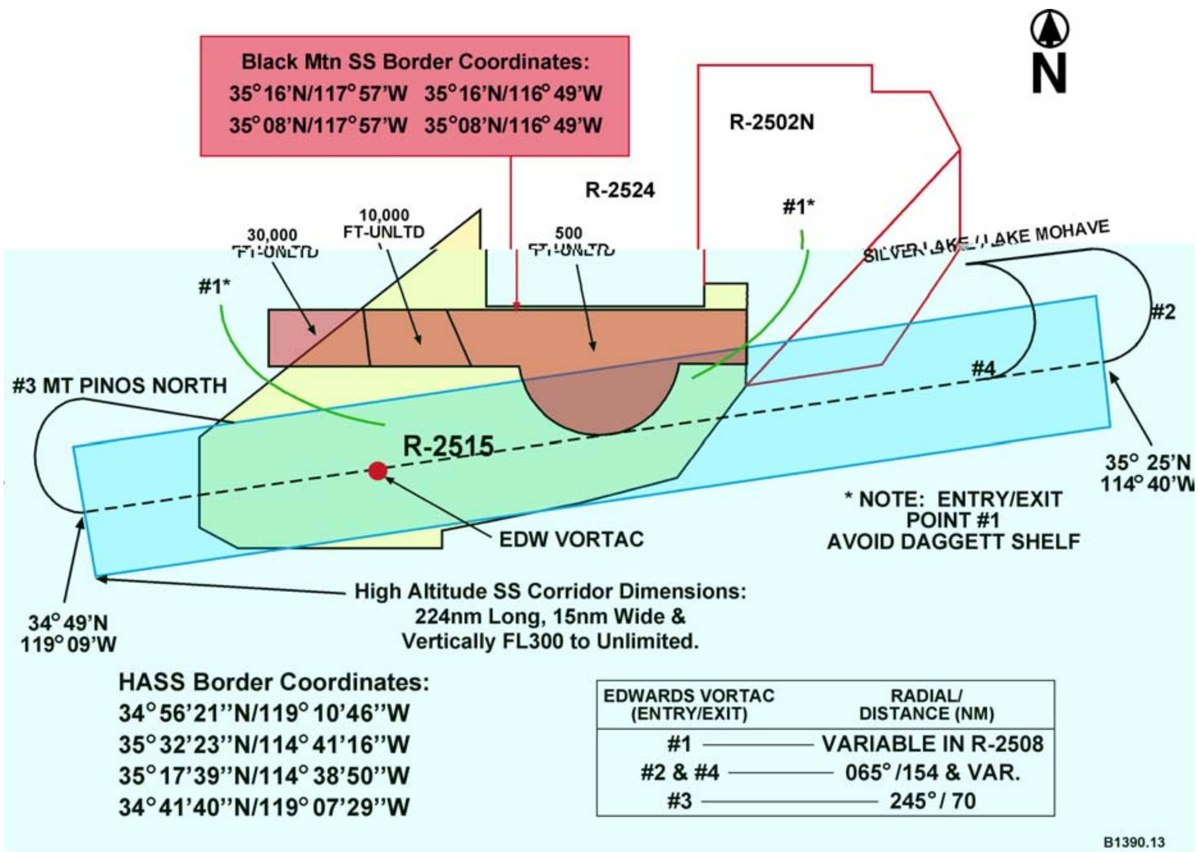


Figure 2-5. *R-2515 Supersonic Corridors*

2.5.6 Tow Operations

Three categories of towed items are allowed within the R-2508 Complex:

(a) Items towed within 500 feet of tow aircraft

(b) Items towed between 500 feet and 1 statute mile from tow aircraft

(c) Items towed more than 1 statute mile from tow aircraft

Regardless of the category, all tow operations will be scheduled with CCF. In addition, the pilot will notify the controlling agency on initial contact of intent to conduct tow operations.

The following rules apply to tow operations:

1. Tow operations are only authorized in VMC conditions. Operations involving categories (a) and (b) require advance notice to the CCF IAW Special Activities scheduling procedures. **Night tow operations are limited to category (a) only**.
2. Category (b) tow operations are considered an additional hazard in the MOAs/ATCAAs and must use a chase aircraft. The chase aircraft must remain close enough to the towed item to provide a visual cue for non-participating aircraft that the towed object is between the chase and towing aircraft.
3. Category (c) tow operations (or category (b) operations where it is not feasible to use a chase aircraft) **must** be approved by a Complex Control Board-recognized Safety Review Board (SRB) or Executive Review Board (ERB) (i.e., AFFTC, NAWCWD, or NASA). Following the SRB/ERB assessment, the project must obtain CCB approval prior to flight. **These operations also require coordination with CCF at least 24 hours prior to the mission being flown.**

WARNING! **If the towed object is inadvertently released, the towing aircraft shall notify JOSHUA immediately. User should consider avoiding populated areas within the Complex while conducting tow operations.**

2.5.7 Airborne Radar Unit (ARU) and Airborne Warning and Control Systems (AWACS) Operations

Air Force AWACS will coordinate procedures and contingency plans with participating military units to ensure compliance by mission aircraft. Navy ARUs will coordinate their procedures and contingency plans with responsible Carrier Air Wing Strike Leader.

Responsibilities for both ARUs and AWACS include:

1. Provide mission frequency to JOSHUA that enables direct contact between JOSHUA and mission aircraft.
2. Obtain orbit airspace to provide service to an exercise taking place within the R-2508 Complex. Aircrews shall:
   - Coordinate with CCF for orbits within R-2508

- Receive a Work Area Clearance from JOSHUA for orbits inside the R-2508 Complex
- Coordinate with CCF and appropriate ARTCC for orbits outside the R-2508 Complex

3. Advise JOSHUA as soon as possible when an aircraft declares an emergency or encounters any unusual situation that requires any form of special handling. Follow these procedures:
   - Initiate a radar correlation check 9Air Force AWACS).
   - Maintain communications with JOSHUA on the appropriate ATC frequency or a pre-coordinated mission/tactical frequency (AWACS/ARU).
   - Do not provide air traffic control services to mission aircraft (e.g., IFR services, ATC clearances, etc.) [AWACS/ARU].
   - Provide coordination for squawks and call signs for inbound/outbound mission aircraft [AWACS/ARU]. However, do not change the Mode 3 discrete beacon code assignment for mission aircraft working inside the R-2508 Complex. Flight split-off aircraft not assigned a Mode 3 discrete beacon code by JOSHUA may be instructed to squawk a non-discrete beacon code while in assigned mission airspace.
   - Provide mission aircraft mission support.
   - Provide JOSHUA with:
     - A 5-minute advance notice of mission completion
     - Call sign of the first element that has completed mission operations in the R-2508 Complex
     - Position of the last mission element that will exit the R-2508 Complex
   - When the mission or a mission element(s) is/are completed, advise mission aircrew(s) to remain within mission-assigned airspace and contact JOSHUA on the ATC frequency.

Responsibilities for JOSHUA are to:

1. Perform all coordination with the appropriate ARTCC for inbound/outbound mission aircraft.
2. Issue a Work Area Clearance and assign a Mode 3 discrete beacon code to mission aircraft.
3. Forward mission aircraft radar data information to the AWACS/ARU to include:
   - Aircraft identification
   - Assigned discrete beacon code
4. Inactively monitor the AWACS/ARU mission/tactical frequency.
5. Provide traffic advisories, traffic alerts on non-mission aircraft operating in the R-2508 Complex, and boundary advisories on the mission/tactical frequency.

6. **<u>NOT</u>** provide advisories between mission aircraft.
7. Issue departure clearances and perform all associated ATC coordination with the appropriate ARTCC.

2.6 Scheduling Large-Scale Exercises

Large-scale exercises are those involving multiple-day/multiple-range activities, more than 10 participating aircraft, and/or are very complex. All large-scale exercises using the R-2508 Complex must coordinate with CCF **at least 30 days in advance** of intended operations.

Depending on the complexity, duration, and size of the exercise area, exercise planners should expect to meet one or more of the following conditions, as determined by the CCB:

1. Provide scenario of exercise plan and airspace requirements to CCF and TRACON by message, e-mail, or fax.

   Message traffic should be addressed to:

   2508CCF EDWARDS AFB CA//

   FAA HIGH DESERT TRACON EDWARDS AFB CA//

2. Coordinate in advance with FAA (ARTCCs, TRACON), Military Representatives to FAA, CCF, and/or other special-use airspace agencies.
3. Set up a mission briefing for all participating aircrews.
4. Generate an operations plan covering detailed operating procedures to which the range agency and CCF will have direct input.
5. Serve as special frequency management liaison.
6. Brief CCB for approval or stipulations for approval, if required by CCB.

> **NOTE:** Mission planners are ***strongly encouraged*** to take advantage of CCFs extensive knowledge and experience in coordinating complex, large-scale exercises. CCF can provide users with coordination requirements, FAA ATC and flight planning requirements and recommendations to achieve overall mission success. Early contact with CCF can prevent major changes to exercise plans.

Most large-scale exercises require the use of airspace/land ranges managed by various members of the Joint Policy and Planning Board (JPPB). Planners must formulate the desired exercise plan along with alternative options as early as possible in order to coordinate mission requirements and negotiate exercise approval.

Most airspace coordination may be handled through the agencies listed in Section 2.3. The following list of organizations that <u>may</u> require separate or additional coordination:

Agency	DSN	Commercial
Air Force Representative to FAA Western-Pacific Region	**833-0481**	**(310) 725-3900**
Navy Representative to FAA Western-Pacific Region	**833-1247**	**(310) 725-3910**
Army Representative to FAA Western-Pacific Region	**833-1250**	**(310) 725-3908**
Los Angeles ARTCC Military Liaison	**640-1290**	**(661) 265-8280**
Oakland ARTCC Military Liaison	**730-1595**	**(510) 745-3334**
High Desert TRACON	**527-2023**	**(661) 277-2023**

2.7 Operating Remotely Operated Aircraft (ROA)

To receive approval for Remotely Operated Aircraft (ROA, which also include UAVs and UCAVs) operations in the R-2508 Complex, submit a detailed proposal to the CCB via the CCF and the appropriate Safety Review Board (SRB) or Executive Review Board (ERB) listed in subsection 2.7.2.

All ROA operations within shared-use airspace require CCB approval that is not delegated.

The proposal should attempt to follow the basic guidelines below that are already approved by the CCB, but each program will be evaluated on a case-by-case basis and approval is contingent upon airworthiness, system maturity, and/or flight safety mitigators (e.g., flight termination system, chase, direct operator control with good comm. links to TRACON, etc.).

This section discusses CCB guidelines that will help ensure that you submit a thorough proposal in enough time for adequate review and advance coordination. If the operations are highly complex or if the proposal deviates significantly from the guidelines below, you should allow more time for coordination.

The guidelines are discussed as follows:

- 2.7.1 Proposal Submission Timelines
- 2.7.2 Safety Review
- 2.7.3 Scheduling and Coordination
- 2.7.4 Post Mission Evaluation

2.7.1 Proposal Submission Timelines

The recommended submission timelines depend on the following:

Type or Part of Program	Submittal Prior to Operations	Reason for Submittal
• Initial contact for a new program • Significant changes to an existing program	**At least 6 months**	• Coordination of Letter of Agreement (LOA)* • CCB consideration and approval
• A previously coordinated program, inactive for over 6 months	**At least 60 days**	• Coordination with CCF
• Final profile and scheduling	**At least 7 days**	• CCF will evaluate and may require schedule changes to minimize impact on other missions (see scheduling process below).
• Profile changes	**At least 3 days**	• Time to brief affected agencies. Changes not received in this time may affect airspace availability.

*LOA coordination takes at least 90 days from the original written request. The LOA depends on CCB agreement with the proposed operating procedures and the results of the Safety Review (discussed below). The LOA is usually worked concurrently with other coordination.

2.7.2 Safety Review

CCB-authorized review organization (AFFTC, NASA Dryden SRB, or NAWCWD ERB only) will review the proposal for safety in accordance with current SRB or ERB governing instructions and applicable internal range procedures.

The reviewing organization shall, at a minimum, consider the CCB guidelines established below or provide an SRB/ERB-recommended equivalent level of safety. When submitting the proposal, address the elements and mitigation’s covered in the Safety Review.

This requirement also applies to operational ROAs proposing to operate within shared-use airspace.

As a minimum, all ROAs operating in shared-use airspace are expected to carry an operable transponder with mode C capability and have some demonstrable means of responding to JOSHUA requests for altitude and/or heading changes in a timely manner.

The Safety Review shall assess the following:

1. Requirement for fight termination system and written procedures addressing when it will be used. Procedures shall address at least the following:
   - Need for redundancy in transponders and flight termination system (RCC 319-92, 313-94)
   - Description of basic conditions that may result in flight termination (e.g., loss of signal, specific data link command, flight plan deviation, etc.)
   - Methodology for termination (e.g., break-apart, parachute recovery, etc.)
   - Determination that footprint from flight termination will not impact no-fly areas (see specific flight plan profile guidelines)
2. Specific flight plan (path, altitude, and speed) profiles. The profiles should:
   - Identify all affected airspace.
   - Describe methodology of controlling the ROA; e.g. man-in-the-loop, autonomous flight plan, etc.
   - Incorporate the no-fly areas (developed by CCB) to avoid direct overflight or flight termination in these areas.
   - Avoid sharp turns within 5 NM (or greater, dependent on ROAs operational limits) of the adjacent non-shared use airspace boundary. Plan for turns to be completed no less than 3 miles from the airspace boundary.
   - State those operations will remain in VMC during all flight (including chase aircraft).
   - When chase aircraft is required, it must be joined up with the ROA before leaving internal restricted areas or Class D airspace, as appropriate. If no chase aircraft, then operations may be restricted to certain airspace and/or altitude restrictions.
   - When chase aircraft is required, it must be joined up with the ROA before leaving internal restricted areas or Class D airspace, as appropriate. If no chase aircraft, then operations may be restricted to certain airspace and/or altitude restrictions.
   - Ensure that the minimum altitudes are not less than those required by this Handbook and the FARs.
   - State your willingness to operate in a “see-and-avoid” environment. Requests for exclusive use operations will normally **not** be approved in shared-use airspace (see guidance in this Handbook).
   - State operational constraints (i.e., distance from control vehicle, speeds, rate of turn, and rate of climb or descent).
   - Include procedures to change heading or altitude for traffic conflict or weather and the proposed coordination process (include timeliness of response to requested action). It is normally expected that JOSHUA can directly communicate with the

ROA controller in such a manner that changes in heading and/or altitude can be made in a timely manner.

NOTE: You may need to coordinate operations through a program representative located in TRACON. This capability should be addressed in the proposal.

- Describe sensor operations and coordination with OPSEC.
- State duration of flight.
- Identify departure and planned recovery location(s).

3. Chase aircraft requirement and procedures. Include:
   - Flight termination and ROA takeover guidance capabilities
   - Standoff distance from ROA
   - Operational limitations, if any, on the chase aircraft
   - Communications capabilities (with ground facilities and ATC)
   - Process for affecting control of the ROA (direct or via ground facility)
   - Join-up procedures, if not immediately after ROA is airborne
   - Chase aircraft and ROA operator briefing on Complex procedures
4. System maturity.
   - Describe prior operations or programs that may indicate the reliability of the system and data link in a similar configuration and operational scenario to that planned. An approved Airworthiness Certificate is a requirement for all proposed ROA configurations (this is a separate document from a "Certificate of Authorization"). Proof-of-concept flights should be, to the maximum extent possible, contained within internal restricted areas until basic airworthiness has been demonstrated.

     New concept and/or low systems maturity ROAs are expected to carry a flight termination system and be chased while operating within shared-use airspace, regardless of altitude. Demonstrated mature systems may be allowed to operate without chase or flight termination system throughout the shared-use airspace contingent upon the recommendation of the appropriate SRB/ERB and approval by the CCB.
   - Include contingency procedures (may be linked to flight termination) to address at least the following:
   - – Loss of internal navigation
   - – Loss of signal uplink
   - – Loss of control of the ROA or the control link with JOSHUA
   - – Signal interference (based on Spectrum Management review of proposed frequencies)

- Proposed resulting action or programmed response for deviations from the flight path. For ROAs that depend on a flight termination signal, address what happens when you are unable to initiate the abort process.
- Loss of tracking (position unknown)
- Loss of transponder (address redundancy requirements)
- Unsatisfactory performance: Does it create a safety hazard or is reliability downgraded?
- DoD or other directed requirement to RTB early (incomplete or interrupted flight plan)
- Loss of control van power; discuss redundancy of power supply to control van or backup unit for control
- FAA coordination/authorization and any operational restrictions that may exist

- Describe your basic recovery plan. Include security issues and coordinating access (see CCB/Land Management Agencies LOA). Address access to DoD lands (internal restricted areas) if this access is not pre-coordinated as part of the flight plan.
- Describe the need for or the accomplishment of the environmental assessment for the proposed activity.

2.7.3 Scheduling and Coordination

Once you receive CCB approval for your ROA operations, and a Letter of Agreement (if required) and all procedures have been finalized between the project, High Desert TRACON, and the CCB, **you must still coordinate and schedule individual operations in the appropriate airspace with the CCF and/or appropriate internal range scheduling activity.**

2.7.4 Post Mission Evaluation

Projects are encouraged to perform a post mission evaluation that discusses the benefits and/or constraints, of the R-2508 UAV/ROA safety review process, and report them to the CCB.

2.8 Flight Planning

Refer to ***DoD FLIP*** for flight plan filing requirements at installations located within the R-2508 Complex. All aircrews filing to land or planning to operate in the Complex must understand and operate in accordance with the R-2508 Complex concept explained in Section 3.1.2 of this Handbook.

- All scheduled operations originating outside the R-2508 Complex shall file in accordance with the following procedures unless the flight will terminate at an installation within the R-2508 Complex.

- These procedures shall be followed to ensure availability of an IFR clearance when flights are ready to RTB. Failure to comply may result in a delay in the Complex while JOSHUA attempts to obtain an IFR clearance.

Call Signs

Call signs provided to CCF for activities in the R-2508 Complex shall not exceed 7 characters/numbers and shall be the same as filed on a DD-175. Two-letter abbreviated call signs, such as BH-1 for "Bloodhound 01," will be interpreted and broadcast as "BRAVO HOTEL 01" by Air Traffic Control (ATC). Tactical call signs shall not exceed 7 characters/numbers and shall be a pronounceable word, in accordance with *DOD FLIP, General Planning (GP), Flight Plans.*

2.8.1 DD Form 175, Military Flight Plan

To file IFR to/from R-2508 Complex (see below):

1. File Two IFR flight plans or legs, one to enter and one to depart the R-2508 Complex.
2. To ensure proper flight plan processing for JOSHUA, **flights not intending to land at an airport within the R-2508 Complex should file "R-2508" as the destination and point of departure for the return flight plan/leg.**

DATE	AIRCRAFT CALL SIGN	AIRCRAFT DESIGNATION
01/01/02	TEST 01	F-22/R

TYPE FLT PLAN	TRUE AIRSPEED	POINT OF DEPARTURE	PROPOSED DEPARTURE TIME (Z)	ALTITUDE	ROUTE OF FLIGHT	TO	ETE
I	450	NFL	1900	290	OAL.. EWALD	R-2508	0+15
I	450	R-2508	2000	290	EWALD..OAL	NFL	0+15

Figure 2-6. *Sample DD Form 175, Military Flight Plan.*

3. Aircraft landing or departing from an airport within the R-2508 Complex should file that airport as the destination and/or departure point of the flight plan.
4. The point of entry/exit into R-2508 airspace should be an R-2508 Entry/Exit fix (see Figure 2-7) as listed in subsection 2.8.2. This does not preclude ATC from clearing aircraft to enter/exit other R-2508 Complex boundary locations.

NOTE: Filing a flight plan does not relieve the aircrew of the responsibility for scheduling the appropriate airspace with CCF.

For VFR flights:

1. Obtain a Work Area Clearance from JOSHUA/SPORT before conducting operations in the R-2508 Complex.
2. All Complex aircraft shall advise JOSHUA/SPORT before departing R-2508 Complex airspace.

2.8.2 R-2508 Complex Entry and Exit Points

Name	Radial / DME	Latitude	Longitude
FAANG	**NLC 043º/77**	**37º00'00"N**	**118º35'03"W**
EWALD	**BTY 274º/71**	**37º12'00"N**	**118º07'45"W**
HAMBO	**BTY 283º/50**	**37º12'00"N**	**117º38'30"W**
HARNE	**BTY 274º/22**	**36º55'30"N**	**117º10'33"W**
JENID	**BTY 175º/27**	**36º21'30"N**	**116º51'03"W**
HEINY	**BTY 154º/58**	**35º51'30"N**	**116º33'00"W**
DAGGS	**EDW 076º/38**	**34º58'08"N**	**116º57'44"W**
ROSIE	**PMD 317º/15**	**34º51'09"N**	**118º12'23"W**
CHADS	***NID 226º/51**	**35º15'00"N**	**118º35'00"W**
ROMOF	***NID 267º/44**	**35º49'45"N**	**118º35'00"W**
SWOOP	**NLC 075º/67**	**36º19'00"N**	**118º35'05"W**
KIOTE	**NLC 062º/68**	**36º34'20"N**	**118º35'24"W**
MITEL	**CZQ 086º/61**	**36º41'04"N**	**118º35'03"W**

***NID TACAN is unmonitored when China Lake airfield is closed.**

FAA published Entry/Exit points.

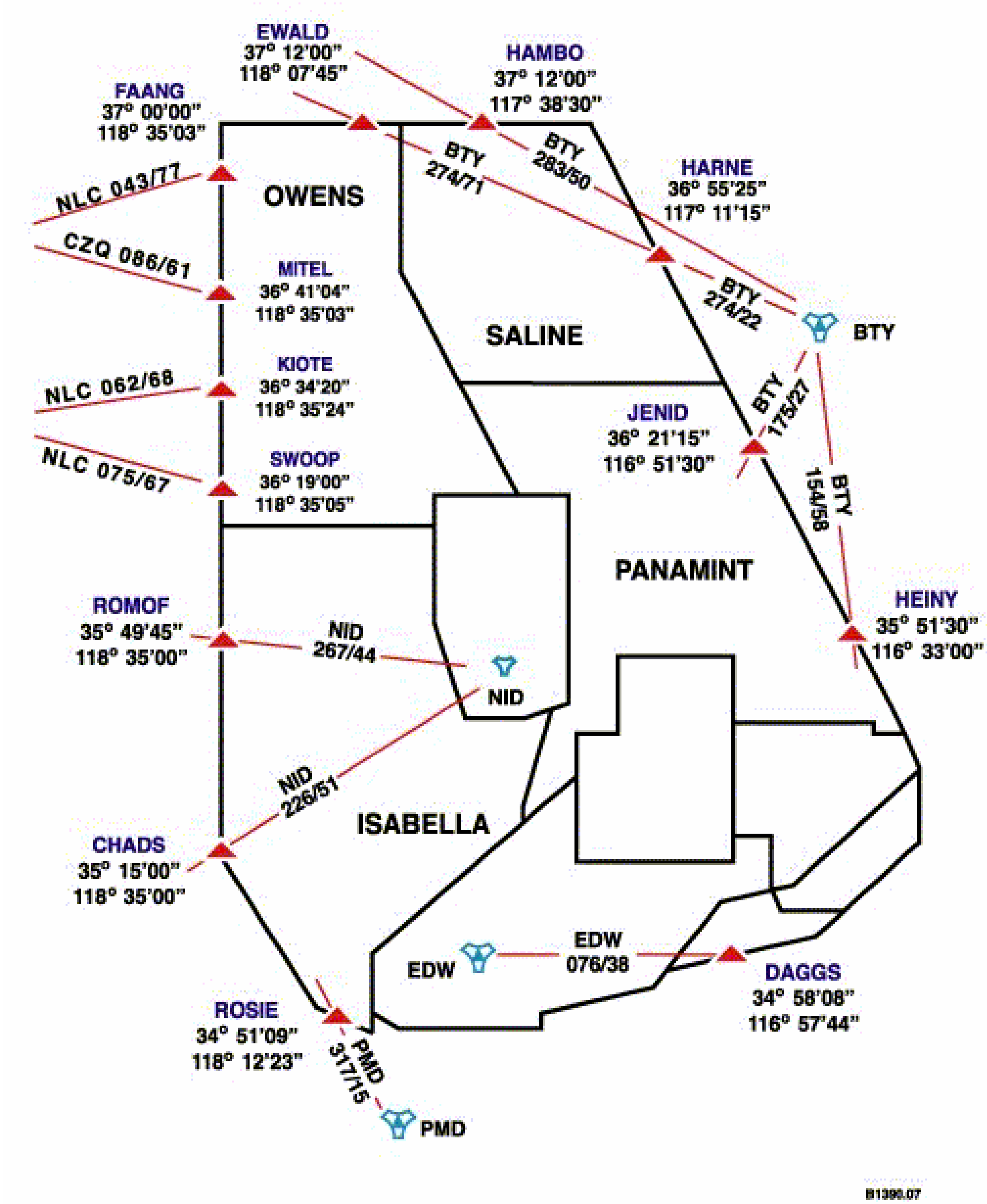


__Figure 2-7.__ R-2508 Complex Entry/Exit Points.

Appendix A: FAA Form 7711-2 Certificate of Waiver or Authorization

One of several uses for FAA form 7711-2 is to apply for a Certificate of Authorization to fly Remotely Operated Aircraft in the National Airspace System. It is provided here as a reference.

CERTIFICATION OF WAIVER OR AUTHORIZATION APPLICATION - PRIVACY ACT

The information on the accompanying form is solicited under authority of Federal Aviation Regulations Parts 91, 101, and 105.

Submission of the information is mandatory.

The purpose of this information is to establish eligibility for certificate of waiver or authorization

The data will be used for recordkeeping and statistical purposes.

Incomplete submission may result in delay or denial of your request.

FAA Form 7711-2 (6-86) Supersedes Previous Edition

DETACH THIS PART BEFORE USING

No certificate may be issued unless a completed application form has been received (14 C.F.R. 91, 101, and 105).

<table>
<tr><td rowspan="4">APPLICATION FOR CERTIFICATE OF WAIVER OR AUTHORIZATION
US Department of Transportation Federal Aviation Administration</td><td colspan="2">Form Approved: O.M.B. No. 2120-0027
APPLICANTS - DO NOT USE THESE SPACES</td></tr>
<tr><td>Region</td><td>Date</td></tr>
<tr><td colspan="2">Action Approved Disapproved -Explain under "Remarks"</td></tr>
<tr><td colspan="2">Signature of authorized FAA representative</td></tr>
<tr><td colspan="3">INSTRUCTIONS Submit this application in triplicate (3) to any FAA Flight Standards district office. Applicants requesting a Certificate of Waiver or Authorization for an aviation event must complete all the applicable items on this form and attach a properly marked 7.5 series Topographic Quadrangle Map(s), published by the U.S. Geological Survey (scale 1:24,000), of the proposed operating area. The map(s) must include scale depictions of the flightlines, showlines, race courses, and the location of the air event control point, Police dispatch, ambulance, and fire fighting equipment. The applicant may also wish to submit photographs and scale diagrams as supplemental material to assist in the FAA's evaluation of a particular site. Application for a Certificate of Waiver or Authorization must be submitted 45 days prior to the requested date of the event. Applicants requesting a Certificate of Waiver or Authorization for activities other than an aviation event will complete items 1 through 8 only and the certification, item 15, on the reverse.</td></tr>
<tr><td>1. Name of organization</td><td colspan="2">2. Name of responsible person</td></tr>
<tr><td colspan="3">3. Permanent mailing address House number and street or route number City State and ZIP code Telephone No.</td></tr>
</table>

4. FAR section and number to be waived			
5. Detailed description of proposed operation *(Attach supplement if needed)*			
6. Area of operation *(Location, altitudes, etc.)*			
7a. Beginning *(Date and hour)*		b. Ending *(Date and hour)*	
Aircraft make and model (a) 8.	Pilot's Name (b)	Certificate number and rating (c)	Home address *(Street, City, State)* (d)

FAA Form 7711-2 (6-86) Supersedes Previous Edition FAA Form 7711-2 (6-86) Supersedes Previous Edition

9. The air event will be sponsored by: *ITEMS 9 THROUGH 14 TO BE FILLED OUT FOR AIR SHOW/AIR RACE WAIVER REQUESTS ONLY.*
mailing address House number and street or route number City State and ZIP code Telephone No. 10. Permanent
11. Policing *(Describe provisions to be made for policing the event.)*

12. Emergency facilities *(Mark all that will be available at time and place of air event.)* Physician Ambulance Crash wagon Fire truck Other -*Specify*
13. Air Traffic control *(Describe method of controlling traffic, including provision for arrival and departure of scheduled aircraft.)*

Hour (a)	Date (b) 14. Schedule of Events *(include arrival and departure of scheduled aircraft and other periods the airport may be open.)*	Event (c)
Please Read	The undersigned applicant accepts full responsibility for the strict observance of the terms of the Certificate of Waiver or Authorization, and understands that the authorization contained in such certificate will be strictly limited to the above described operation. *If sufficient space is not available, the entire schedule of events may be submitted on separate sheets, in the order and manner indicated above.*	

15. Certification - I CERTIFY that the foregoing statements are true.
Date Signature of Applicant
Remarks

Appendix B: FAA Order 7610.4K, Chapter 12, Section 9

(Effective February 19, 2004)

REMOTELY OPERATED AIRCRAFT (ROA)

12-9-1. OPERATION

a. ROA Operations should normally be conducted in the following areas:

1. Within Restricted Areas.

2. Within Warning Areas.

b. For those operations that cannot be contained wholly within Restricted Areas or Warning Areas, the ROA operations shall be conducted in accordance with procedures outlined in paragraph 12-9-2, Procedures.

NOTE-
Procedures for nonjoint-use DOD airfield operations will be as specified by DOD.

12-9-2. PROCEDURES

ROAs operating outside Restricted Areas and Warning Areas shall comply with the following:

a. At least 60 days prior to the proposed commencement of ROA operations, the proponent shall submit an application for a Certificate of Authorization (COA) to the Air Traffic Division of the appropriate FAA regional office. COA guidance can be found in FAA Handbook 7210.3, Facility Operation and Administration, Part 6, Chapter 18, Waivers, Authorizations, Exemptions, and Flight Restrictions. The following documentation should be included in the request:

NOTE-
In the event of real-time, short notice, contingency operations, this lead time may be reduced to the absolute minimum necessary to safely accomplish the mission.

1. Detailed description of the intended flight operation including the classification of the airspace to be utilized.

2. ROA physical characteristics.

3. Flight performance characteristics.

4. Method of pilotage and proposed method to avoid other traffic.

NOTE-
Approvals for ROA operations should require the proponent to provide the ROA with a method that provides an equivalent level of safety, comparable to see-and-avoid requirements for manned aircraft. Methods to consider include, but are not limited to; radar observation, forward or side looking cameras, electronic detection systems, visual observation from one or more ground sites, monitored by patrol or chase aircraft, or a combination thereof.

5. Coordination procedures.

6. Communications procedures.

7. Route and altitude procedures.

8. Lost link/mission abort procedures.

9. A statement from the DOD proponent that the ROA is airworthy.

NOTE-
The proponent should ensure that the ROA contains a means to safely terminate the flight, follow specified and defined procedures for mission abort, or proceed in accordance with specific flight termination procedures.

b. COAs shall have an effective date with a duration not to exceed 1 year unless renewed or revalidated. The COA expires on the stated termination date, unless sooner surrendered by the proponent, or revoked by the issuing agency.

c. ROAs shall be equipped with standard aircraft anti-collision lights in accordance with criteria stipulated in 14 CFR Section 23.1401. These lights shall be operated during all phases of flight in order to enhance flight safety.

d. ROAs shall be equipped with an altitude encoding transponder that meets the specifications of 14 CFR Section 91.215. The transponder shall be set to operate on a code assigned by air traffic control. Unless the use of a specific, special-use code is authorized, the ROA pilot-in-command shall have the capability to reset the transponder code while the ROA is airborne. If the transponder becomes inoperative, at the discretion of the affected region or air traffic facility, the mission may be canceled and/or recalled.

e. Instantaneous two-way radio communication with all affected ATC facilities is required. For limited range, short duration flights, proponents may request relief from radio requirements provided a suitable means of alternate communication is available. Compliance with all ATC clearances is mandatory.

f. The proponent and/or its representatives shall be noted as responsible at all times for collision avoidance maneuvers with nonparticipating aircraft and the safety of persons or property on the surface.

Appendix D: Defense Contract Management Agency INST 8210.1: UAV Pilot Qualifications

The following excerpts are taken from the DCMA Instruction 8210.1. They describe minimum qualifications for approval of contractor crewmembers (pilots/operators) for test and other flight categories of UAVs.

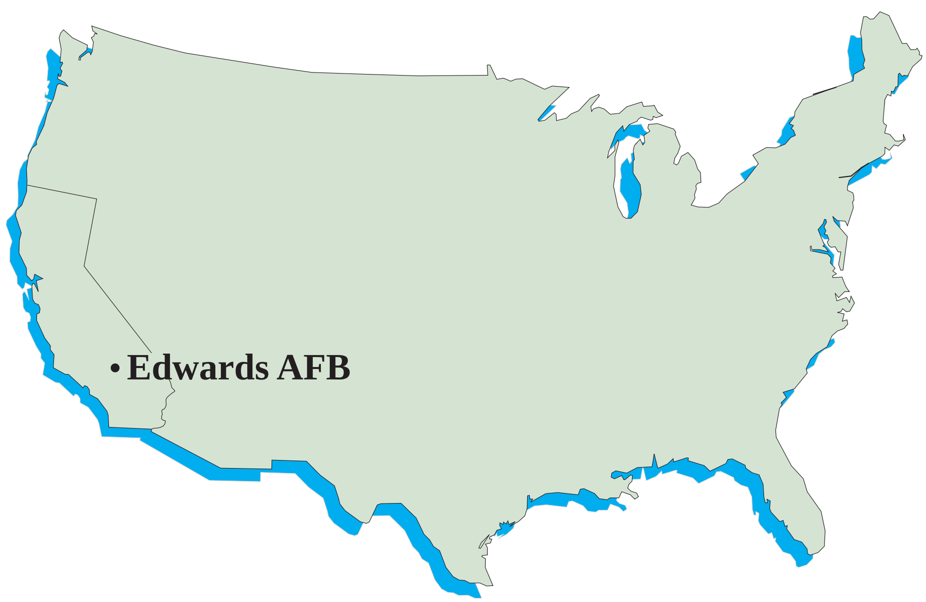
3.6. UAV Pilot Qualifications. All UAV pilots must be approved in writing by the Government Flight Representatives (GFR) prior to operating any aircraft under the G&FRC/AFRC, and shall be sufficiently qualified to make certain he/she can operate the UAV in a safe and effective manner. No one shall serve as pilot/pilot-in-command for two or more UAVs simultaneously.

3.6.1. UAV pilots operating *exclusively* in Restricted or Warning airspace, as designated in DoD Flight Information Publications and DOT/FAA aeronautical charts, shall hold ratings and qualifications consistent with specific contractual wording, or Service requirements for UAVs/ROAs. If Service/contractual guidance does not exist, then the GFR shall approve/disapprove UAV pilots/operators based upon the requirements of paragraph 3.6.2. below.

3.6.2. UAVs operating outside of Restricted or Warning airspace shall do so only under an FAA MOU/MOA or similar document. UAV pilots operating UAVs outside of Restricted or Warning airspace shall: hold at least a private pilot's certification; an instrument rating; pass an annual instrument review; and have a total of 300 flight hours as pilot-in-command or Mission Commander (UAVs or aircraft) - 100 of which must be in a manned aircraft; hold a current FAA UAV pilot certification (when such a certification exists); and comply with Service Guidance concerning pilot qualifications/currencies if more restrictive than either of the above requirements.

95th Air Base Wing
Air Force Flight Test Center
Edwards Air Force Base, California

SUMMARY OF UNMANNED AERIAL VEHICLE SAFETY REGULATIONS AND PROCESSES FOR FLIGHT OPERATIONS AT EDWARDS AIR FORCE BASE



Final

November 2005

This page intentionally left blank.

TABLE OF CONTENTS

LIST OF TABLES

This page intentionally left blank.

1.0 PURPOSE

The purpose of this report is to provide a brief summary of the current safety review requirements, regulations and procedures used at the Air Force Flight Test Center (AFFTC) to approve/certify Unmanned Aerial Vehicles (UAVs)[1] for test flights in the restricted airspace surrounding Edwards Air Force Base (AFB). The current safety review and approval processes for test flight of manned aircraft and UAVs are managed under the same AFFTC Safety Instruction (regulation) for all common functions. The exception is that an AFFTC Flight Operations regulation includes a special section to account for the different vehicle characteristics, capabilities and operating procedures unique to UAVs. Also, a Range Commanders Council (RCC) document provides additional guidance for conducting UAV hazard assessments and risk analyses at the various test Ranges.

In addition to the UAV flights within the AFFTC Test Range Restricted Airspace, UAV test flights can extend to the Nevada Test and Training Range managed by the Air Force Warfare Center (USAFWFC) at Nellis AFB, and to the Naval Air Warfare Center-Weapons Division (NAWC-WD) Sea Range near Point Mugu, California. These extended flights provide more realistic testing over different routes. The flights require traveling through a band of FAA controlled civil airspace before entering the other Ranges' restricted airspace. This report includes a summary of the applicable AFFTC safety regulations and applicable Federal Aviation Administration (FAA) policies and regulations to obtain UAV flight approval and ensure safe operations.

2.0 BACKGROUND

Many UAVs have been flight tested during the past decade, including tests from the AFFTC at Edwards AFB and other test ranges in the United States. The utility of the systems has been demonstrated extensively for military and other government missions, and a growing demand is evident for commercial use as well. The systems have matured significantly with testing and operational use; some have flown over 100,000 hours. The reliability of the systems has substantially improved over time and the DoD, National Aeronautics and Space Administration (NASA), FAA and industry are now actively working to modify the FAA regulations and approval processes and procedures to more effectively integrate UAV flights into the National Airspace System (NAS). A comprehensive Office of the Secretary of Defense

[1] The terms UAV, Remotely Operated Aircraft (ROA), Unmanned Aircraft Systems (UAS), and Unmanned Aircraft (UA) are used almost interchangeably by the many references to refer to the same class of aircraft. The term UAV is used exclusively in this Report to avoid confusion.

(OSD) UAV reliability report[2], was published to "(1) allow an assessment of the risk posed by unmanned aviation to persons and property in the development of airspace regulations and (2) identify potential means for improving their mission availability, reliability, and effectiveness." The OSD recently published an Unmanned Aircraft Systems Roadmap[3] and an Airspace Integration Plan for Unmanned Aviation[4]. These documents will be referenced in this Report as they pertain to DoD and FAA safety related regulations. DoD and FAA have agreed to treat UAVs as aircraft for regulatory purposes.

3.0 AFFTC SAFETY REVIEW PROCESS FOR AIRCRAFT AND UAV TESTS

The AFFTC Instruction[5] (regulation) 91-5, directs the application of system safety principles to the planning and implementation of all aircraft tests at Edwards AFB. It also provides the guidance for the application of system safety principles to AFFTC training programs, logistics testing, and publications. The objective of the safety process is to reduce risk of dangerous mishaps during tests by identifying the tests' unique hazards that can injure people or damage property, and establish minimizing procedures/corrective actions to eliminate or control the hazards. Independent reviewers assess the risk reduction (mitigation) proposed by the UAV operator and assess the overall risk to people, equipment and facilities of the test program. The AFFTC Commander or a designated representative must review and then approve the mitigation measures and associated risk levels.

The AFFTC Instruction (AFFTCI) applies to all ground and flight test activities involving AFFTC assets (personnel, aircraft, equipment, facilities, airspace, and the general public which the AFFTC Commander has responsibility for as the Lead Range and Test Facility Base Commander). The AFFTC Commander is delegated safety responsibility for all test range activities in accordance with a Department of Defense Directive[6].

Flight testing of developmental or prototype UAVs requires thorough analysis to determine the risk level. Early UAV tests and special tests, such as extended flight profiles, require comprehensive risk analyses

---

[2] Office of the Secretary of Defense, *Unmanned Aerial Vehicle Reliability Study, February 2003*

[3] Office of the Secretary of Defense, *Unmanned Aircraft System (UAV) Roadmap 2005-2030*

[4] Office of the Secretary of Defense, *Airspace Integration Plan for Unmanned Aviation, November 2004*

[5] Air Force Flight Test Center Instruction 91-5, *AFFTC Test Safety Review Process*, *12 March 2002*,

[6] Department of Defense Directive 3200.11, *Major Range and Test Facilities Base (MRTFB), 1 May 2002*

utilizing a process outlined in the Range Commanders Council (RCC) Document 323-99[7], to be discussed in Section 5.0. If this early analysis clearly indicates that the predicted vehicle performance and other established criteria are well within acceptable levels, based on simulations and prior flight tests, the extent of the safety evaluation may be reduced.

Early in the test planning cycle the UAV operator (customer) meets with the AFFTC Project Manager and Safety Officer to discuss the test requirements, and then submits a Program Introduction (PI) document that includes the test requirements. The AFFTC test support personnel prepare a Statement of Capability (SOC) to inform the potential customer of the requirements, capabilities and resources needed to support the testing of the UAV. The PI and SOC documents are prepared in accordance with the RCC Universal Documentation System that is the standard for submitting program test requirements, range support capabilities and operations plans at all major test ranges. The SOC includes a description of the AFFTC Safety Review requirements including the need for an independent review of the hazard identification and risk reduction measures. Risks to personnel and assets must be assessed and approved by responsible AFFTC authority in accordance with AFFTCI 91-5. The AFFTC Project Manager, with customer support, is responsible for ensuring this review is accomplished on time to support the test schedule. The schedule for the final safety review and the coordination/completion of the safety plan, which includes the test plan, is provided to the customer along with the information on mishap accountability, investigating responsibilities and other related matters.

AFFTCI 91-5 describes the responsibilities of the various offices and personnel involved in the test planning and operations, the safety planning and review processes and procedures, test conduct responsibilities and approvals, and specific instructions applicable to safety review boards and documentation.

3.1 SAFETY PLANNING

Safety planning and technical planning is an integral and iterative process involving identification and mitigation of hazards as follows:

Step 1: Identify Hazards. The test team will identify hazards generated by each test or activity (a hazard is any condition that has the potential of causing a dangerous mishap resulting to injury or property damage). This involves review of the program office and contractor/developer system safety plans and analyses, System Safety Working Group results, previous test results, and other related information.

[7] Range Commanders Council Document 323-99, *Range Safety Criteria for Unmanned Air Vehicles, December 1999*

Step 2: Eliminate/Control Test Hazards. The test team will take action to eliminate the identified test hazards or control them to an acceptable level of risk. This involves such actions as changes in design, incorporation of safety devices, improving procedures and training programs.

Step 3: Prepare draft Safety Paperwork. Complete the AFFTC Form 5058[8] and associated documents to include Test Hazard Analysis.

Step 4: Conduct Technical Review. The test team will complete a Technical Review[9] to assess test safety implications and update the safety documentation as appropriate.

Step 5: Revise/Review Safety Paperwork. Prepare documentation required for the safety review. The required forms and test plan are coordinated with all appropriate officials and include supporting documentation to justify the final hazard analysis and risk assessment.

3.2 SAFETY REVIEW

After the Safety Plan is complete, the AFFTC Safety Test Office will determine if a Safety Review Board meeting is required based on the scope, complexity, similarity to previous test, and anticipated risk level of the test. The Safety Official may determine that certain specialists, such as Air Traffic Control (ATC) representatives, should review the package to evaluate specific issues and assess the risk of the test program in accordance with the approach specified in the AFFTC Instruction.

If the formal Safety Review Board meeting is required, Board members, including test operations and engineering personnel with appropriate expertise, are assembled and a structured briefing describing the test plan and safety risk assessment is presented for review and approval or comment. Issues and concerns, if any, are to be resolved in a timely manner.

Following the Safety Review Board meeting, the Safety Official will provide a synopsis to the test team before the synopsis is consolidated into the Test Documentation Package with the other information in AFFTC Form 5028. The Safety Documentation Package (on AFFTC Form 5028) includes a Technical Adequacy Letter, Test/Training Plan, and supporting documentation for final coordination, signatures and approval. An "approval authority briefing" is presented to the appropriate AFFTC management personnel with the test team members, including the test conductor, pilot and project engineer in attendance. The

[8] AFFTCI 91-5 is a structured process designed to provide a comprehensive and consistent safety planning and review process. AFFTC Form 5028, *Test Project Safety Review* (Initial and Amendment) is used to document and approve safety planning and amendments, and AFFTC Form 5028A, *Test Hazard Analysis,* is used to document specific test hazards.

[9] per Air Force Flight Test Center Instruction 99-1, *Test and Evaluation – Test Plans, 28 January 2002*

final Decision Authority is the Operations Group Commander, Test Wing Commander, or the AFFTC Commander depending on the risk level (Low, Medium, or High).

3.3 TEST CONDUCT

The test is conducted within the scope of the approved AFFTC Form 5028 using the procedures and restrictions as documented. The procedures/restrictions documented in AFFTC Forms 5028/5028A are addressed during the mission briefing. All General Minimizing Considerations and Test Hazards Analyses applicable to that particular mission will be covered regardless of the risk level assigned to the test. Range Safety representatives will monitor the flight tests to ensure safeguards and operating limits recommended by the Safety Review Board and approved by the Decision Authority are followed. Oversight of flight planning, preflight, and flight will be provided

There are provisions in the AFFTC regulation to cover the procedures for "unusual events" (safety-related) that may occur during a test program. Applicable tests will be placed on hold. Unusual events may include (1) damage to the test vehicle or support equipment, (2) exceed the test safety limits, or (3) unfavorable departure from predicted simulation/analysis.

Additional safety planning and amendments to the safety document are required for changes to the test activity, unexpected results, restrictions or controls, hazards not previously identified or controlled, or a change in risk level is warranted. A major test plan change will require the same level of review as a new test plan and will be documented on a Long Amendment form. Other less significant changes to the Safety Package are documented, coordinated and attached as short amendments, memos or administrative changes. The Safety Packages are valid for one year and can be updated; including lessons learned findings, using a Continuation Amendment form and process.

The AFFTCI 91-5 has attachments that provide clear instructions and checklists on the contents and safety analysis required in AFFTC Forms 5028 and 5028A. Additionally, attachments are included, in AFFTCI 91-5, on AFFTC Risk Assessment Method and on Hazard Identification and Minimization requirements and checklist.

4.0 AFFTC FLIGHT OPERATIONS PROCEDURE FOR UAVs

Guidelines for conducting UAV operations from Edwards AFB and in the surrounding restricted airspaces are provided in Chapter 15 of a regulation, called AFFTC Instruction 11-1[10]. The guidelines are indexed on individual UAV capability and maturity, and allow for varying levels of integration with other airfield operations and users. All UAVs must abide by the overall guidance contained in the entire AFFTCI 11-1 as applicable to flight operations in addition to those specific to UAVs in Chapter 15.

AFFTCI 11-1 supplements the AFFTC safety process as outlined in AFFTCI 91-5 above. Operating limitations and restrictions contained in the guidelines are considered to be the minimum acceptable level of restriction. The AFFTC Safety Review Board may recommend increased and/or new restrictions based on project specific considerations. The Safety Review Board will evaluate each UAV system for risks associated with system redundancy, test team training, and contingency planning to include system malfunctions. The Safety Review Board will also determine training requirements for operators to ensure a basic level of aviation knowledge and skill before flights outside the exclusive use airspace are allowed.

During the safety review process, the UAV will be assigned a Type Designation and Maturity Level. The Mitigating Procedures specified for combinations of Type Designation and Maturity Level are as shown in Table 4-1, and become the guideline for Safety Review Board-established mitigating procedures. As a system matures it must meet specific "Exit Criteria" to progress to the next higher level of maturity. Minimum required Exit Criteria are included in the AFFTC Instruction. After a significant change to the UAV affecting safety of flight (e.g. flight control design change, flight control or mission planning software changes), the maturity level will change to “Unproven” until the modification is fully tested and evaluated. Maturity level may also change with phase of flight depending on the type of test being flown, such as, flights near the airfield versus flight envelope expansion flights. Type changes must be approved by the Safety Review Board.

Table 4-1 is followed by the description of Maturity Levels, Exit Criteria, Type Designation, and Mitigating Procedures acronyms from AFFTCI 11-1. Note that this document will be updated as the UAV test program progresses to make changes as deemed appropriate for safe and successful flight operations.

[10] Air Force Flight Test Center Instruction 11-1, *Flying Operations*, Chapter 15 *Remotely Operated Aircraft (ROA/UAV), 14 January 2004*

Table 4-1

UAV Mitigation Matrix

	Type 1	Type 2	Type 3	Type 4	Type 5
Mature		BA	BA TA	BA TA	EUA or BA/CA TA
Provisional	BA	BA	BA TA	BA TA	EUA or BA/CA TA
Experimental	BA FL FTS	BA FL FTS	BA FL FTS GC	BA/CA FL FTS GC	EUA FL FTS GC
Unproven	EUA or BA/CA FS TE/LE/RC or LBT/LBL or RC/CF FTS ST	EUA or BA/CA FS TE/LE/RC or LBT/LBL or RC/CF FTS ST	EUA or BA/CA FS TE/LE/RC or LBT/LBL or RC/CF FTS GC ST	EUA FS TE/LE/RC or LBT/LBL or RC/CF FTS GC ST	EUA FS TE/LE/RC or LBT/LBL or RC/CF FTS GC ST

Note: a '/' indicates all listed mitigating factors on that line of the cell are required -- read as 'and'. Each line in the cell indicates additional mitigating factors required

UAV Maturity Levels, Type Designation, and Mitigating Procedures[11]

Maturity Levels

Maturity level of the UAV will be set to minimize risk overall risk in the test program, and will be based on confidence level in individual aircraft systems as well as demonstrated aircraft performance and maturity.

Unproven*:* The overall aircraft or any individual safety-of-flight related system is untested.

EXIT CRITERIA: 5 consecutive takeoff approach and landing cycles over 5 separate test periods without a safety-of-flight critical failure or serious deviation from the flight plan. Aircraft has demonstrated it is controllable in the assigned airspace for planned maneuvers with no hazardous characteristics.

Experimental: The aircraft is in active developmental flight test. Basic flight envelope and handling qualities testing are complete. (Note experimental in this sense does not denote "X" aircraft such as the X-45.)

EXIT CRITERIA: Baseline developmental test program is complete. In addition, the system will need to demonstrate a minimum of 30 consecutive successful takeoff approach and landing cycles during a minimum of 15 separate test periods to show a reliability of 0.9 with a 0.95 confidence level. Aircraft failure modes are tested and well understood.

Provisional*:* The aircraft has completed baseline airframe developmental testing, though operational testing may be ongoing.

EXIT CRITERIA: Aircraft has fulfilled Initial Operating Capability requirements.

Mature*:* The aircraft has been declared operational.

Type Designation

UAVs will be assigned a Type designation based on the overall capability of the UAV, primarily for traffic avoidance purposes. Capability must be tested for suitability before it can be considered for categorizing the UAV, and may be via on-board or off-board systems.

Type 1: UAV operator has the ability to conduct see and avoid to an equivalent level of capability as a manned aircraft (cooperative and non-cooperative traffic).

[11] This section is taken directly from AFFTC Instruction 11-1, Chapter 15 with minor format and text changes to enhance readability. The Instruction is subject to change as UAV flight testing progresses.

Type 2: UAV operator able to detect factor traffic (cooperative only) and take appropriate avoidance action in a timely manner (usually within a few seconds). The detection to action decision loop only involves the UAV and the operator.

Type 3: UAV operator able to detect factor traffic (cooperative only), but unable to react in a timely manner (usually within a few seconds). This delay may be due to detection method (ATC traffic monitoring, Chase aircraft) and/or command signal delay (latency) inherent in UAV system (long link delays, complicated command sequences).

Type 4: UAV unable to deviate from flight path for traffic avoidance, but conflict may be detected by Air Traffic Control (ATC) to direct conflicting traffic to maneuver (ATC transponder required).

Type 5: UAV unable to deviate from flight path for traffic avoidance and ATC unable to accurately track UAV to detect traffic conflicts (no transponder).

Mitigating Procedures.

These mitigating procedures are defined to enable Table 1 to be populated. Not all mitigating procedures are utilized in the table, but are defined here to enable the Safety Review Board (SRB) to standardize mitigation procedures.

See and Avoid Mitigation

Exclusive Use Airspace (EUA): Airspace dedicated to the sole use of the UAV mission. Non-participating traffic is prohibited from entering. AFFTC Radar Control Facility is responsible for directing non-participant traffic to avoid entering and advising the UAV operator if there is an airspace incursion. UAV operations are required to remain within the confines of the airspace boundaries.

Airspace bubble (BA): A 2000’ vertical or 5 Nautical Miles horizontal airspace bubble around the UAV that traffic is advised to remain clear. The Radar Control Facility is responsible for advising traffic of proximity to bubble and current direction and altitude of UAV. The operator will be prepared to make avoidance maneuver if required.

Chase aircraft (CA): Primary purpose is to conduct see and avoid for both the UAV and the chase aircraft. Will advise the UAV operator of all traffic conflicts and recommend or direct a course of action as appropriate.

Traffic Avoidance (TA): UAV operator depends on ATC active monitoring to detect traffic and advise UAV operator of all traffic conflicts and recommended avoidance maneuver.

Ground Hazard Mitigation

Sanitized ground footprint (FS): Geographic area on the ground actively cleared of all personnel. Risk is accepted to structures and vehicles remaining within the footprint in case of an aircraft crash. Flight path is planned to afford the maximum practical protection for personnel.

Limited ground footprint (FL): Geographic area on the ground with widely dispersed population and/or structures. Flight path is planned to minimize personnel risk exposure.

Airfield Conflict Avoidance

Sanitized Taxi Route (ST): Taxi route from engine start location to runway is cleared of all non-participant aircraft, ground vehicles and personnel.

Ground chase vehicle (GC): Primary purpose is to monitor UAV ground operations/taxi for conflicts with aircraft, personnel and structures. Will advise the UAV operator of all traffic conflicts and recommend or direct a course of action as appropriate.

Takeoff exclusion zone (TE): Designated zone around takeoff runway to minimize risk to personnel, aircraft and equipment from a takeoff accident. Active procedures are utilized to prevent non-participating personnel from being within the exclusion zone.

Landing exclusion zone (LE): Designated zone around landing runway to minimize risk to personnel, aircraft and equipment from a landing accident. Active procedures are utilized to prevent non-participating personnel from being within the exclusion zone.

Road closure (RC): Closure of roads the UAV ground track crosses to minimize risk to drivers and their vehicles. Active procedures are utilized to stop traffic at a safe distance from the UAV ground track.

Closed field operation (CF): UAV operations are restricted to hours when the airfield is closed to all other air traffic.

Lakebed takeoff (LBT): UAV takeoff restricted to approved/coordinated lakebed surfaces only.

Lakebed landing (LBL): UAV landing restricted to approved/coordinated lakebed surfaces only.

Flight Termination System (FTS): UAVs with a hazard zone (footprint) that can always be contained within restricted area R-2515 airspace land boundaries without endangering range assets, populated areas, or sensitive areas may not require an FTS. This determination shall be made as part of the AFFTC safety review process. If so required, the UAV shall be equipped with an AFFTC or Dryden Flight Research Center approved FTS. If a chase aircraft is required, the chase aircraft shall have the ability to terminate the UAV or shall have direct communications with the ground control facility having flight termination responsibility. An FTS meeting the requirements of Range Commander's Council Standards 319-92 and

313-94 is desired, however deviations from these standards shall be considered on a case-by-case basis. Detailed requirements for FTS certification, testing, and approval are contained within appropriate Range Safety documents.

5.0 STANDARD RANGE SAFETY CRITERIA FOR UAVs

The RCC develops guidance documents and standards for use by the major DoD test and training Ranges/Centers. There are 20 DoD Ranges/Centers that are members of the RCC. The RCC has an Executive Committee and Working Groups that participate in the development of common operating procedures, standards and approaches to a variety of topics related to Range operations, including safety. The AFFTC, Naval Air Warfare Center Weapon Division at Point Mugu, and the Air Force Warfare Center at Nellis AFB are all members of the RCC.

5.1 RANGE COMMANDERS COUNCIL DOCUMENTS

The RCC Range Safety Working Group developed a detailed guidance document, RCC Document 323-99[12], and supplement document[13], for use by the Test Centers and Ranges to provide a common approach for the Range Commander to make decisions regarding UAV flight operations, specifically on the subject of safety. These documents are used as a guide by the Test Directors and Range Safety Offices to supplement local Directives and Instructions/regulations to evaluate UAV hazards and associated risks. The goal is to identify hazards and mitigate/minimize risks to ensure safe and successful test operations. A brief summary of the RCC Document 323-99 follows.

5.2 RANGE SAFETY CRITERIA

RCC Document 323-99 contains a structured approach to risk management. Five key criteria are discussed in detail in the RCC document to assess the question; "Is it safe to fly?"

The criteria are derived from existing standards, policies, and established procedures. The RCC Document describes the five criteria and the conditions necessary to meet the criteria. The RCC Supplement provides extensive rational and methodology supporting the criteria. These criteria are grouped under key questions as follows.

Are system hazards recognized and risk controls available?

---

[12] See Ref #5

[13] Range Commanders Council Supplement Document 323-99, *Range Safety Criteria for Unmanned Air Vehicles -- Rationale and Methodology Supplement, April 2001*

- Risk management criteria

How is the range vulnerable to these identified system hazards?

- Casualty expectation criteria
- Property damage criteria
- Midair collision avoidance criteria

If safeguards are needed to reduce risk, will they work?

- Adequacy of safeguards criteria

Each of these five criteria is summarized in the following paragraphs.

5.2.1 Risk Management

The goal of risk management criteria is to ensure system hazards, which may affect range safety, are recognized, and have control measures available. Several steps are involved in meeting the risk management criteria. They include hazard identification, hazard assessment, hazard controls, and supervision to oversee strict adherence to controls and procedures.

5.2.2 Casualty and Property Damage

Casualty expectation is a determination of the probability of a significant injury resulting from a mishap during a UAV test operation. Property damage expectation is the probability of damaging or destroying property. Casualty expectation criteria, and property damage criteria, are developed to ensure that the risks to people and high value property identified in the hazard analysis are reduced to an acceptable level. Acceptable criteria are achieved by conducting the hazardous operation away from populated areas, when feasible, and limiting exposure to the hazard through careful mission planning, route selection over low population areas, and UAV testing and reliability enhancements.

5.2.3 Midair Collision Avoidance

Midair collision avoidance criteria are reviewed for three different situations: (1) Exclusive Use within restricted airspaces or warning areas, (2) Shared Use within restricted airspaces or warning areas, and (3) UAV operations in other than restricted airspace and warning areas, such as the NAS.

5.2.3.1 Exclusive Use Airspace

The exclusive use airspace criteria are met if the UAV is required to be contained inside the restricted airspace or a warning area, non-participants aircraft are excluded, and participating aircraft are adequately briefed. Conditions for ensuring that the criteria are met are specified in standardized local procedures. Local standard operating procedures are also in place to ensure that flight crews and air traffic controllers understand the operation and limitations of the UAV. Midair collision is avoided because the UAV is the only aircraft allowed to participate in the test mission.

5.2.3.2 Shared Use Airspace

During a test when shared use of the airspace or warning area is permitted, the differences between the UAV and manned aircraft, such as "see and avoid," are accounted for. These considerations include the recognition of different ways the UAV can fail (failure modes), previous test history, and airspace allocations. Other possible requirements may include installation of a Range approved and highly reliable system, such as flight termination systems (e.g. destruct or fuel shutoff), to ensure the vehicle does not leave assigned airspace. The communications and control links, and associated software, must be proven highly reliable to verify that the UAV operator and the air traffic controllers can monitor vehicle position at all times and that emergency mission recovery options are available and can be executed in a timely manner. The "see and avoid" requirements for manned aircraft can be essentially satisfied for UAVs by the use of onboard sensors, transponders, radar surveillance, ground observers and/or chase planes with a test plan that considers the control and communications capabilities and performance limitations of the vehicle.

5.2.3.3 National Airspace Use

The use of the National Aerospace System (NAS) is required when the UAV is flown between the AFFTC Range Restricted and Warning Areas and another test Range (e.g. Navy Sea Range or Nevada Test and Training Range) Restricted and Warning Areas. The FAA is responsible for aircraft traffic separation during Instrument Flight Rule (IFR) conditions, and is responsible for regulations regarding aircraft traffic separation in Visual Flight Rules (VFR) conditions. The FAA must authorize and approve the flight before the time the UAV is in the NAS. The UAV containment and compensating or mitigation measures are the same as those described in the previous paragraph plus strict compliance with the FAA regulations and procedures. The FAA regulations and approval processes required for UAV flights within the NAS are described in more detail in Section 7.0**.**

5.2.4 Adequacy of Safeguards

Criteria for reliability and adequacy of safeguards are included in the RCC 393-99 document. There must be evidence to show that required safeguards will mitigate the most dangerous aspects of the UAV operation. Safeguards must be provided if the hazard analysis requires it or if the UAV test operation does not meet other safety criteria (e.g. casualty expectation, property damage, collision avoidance) without it. Optional systems considered as safeguards include emergency remote pilots, flight termination systems, software "fly home" routines, and parachutes. Reliability criteria are established for required safeguards and must have been proven through testing, analysis and demonstration. These emergency procedures, checklists, operator certification, and training are established and validated for approval by the Range Commander or delegated representative.

6.0 SUPPORT RANGES

The other DoD Ranges supporting AFFTC with UAV testing are the Naval Air Warfare Center - Weapons Division’s (NAWC-WD) Sea Test Range at Point Mugu, California and the Air Force Warfare Center's (USAFWFC) Nevada Test and Training Range, Nellis AFB, Nevada. Each Range has designated restricted airspace and warning areas that are available to support UAV flights from AFFTC. NAWC-WD and USAFWFC have Range Instructions and Manuals that are similar to and compatible with AFFTC Instructions and the RCC Documents and Guidelines described earlier. The Range Safety Office is responsible for flight safety analysis including flight termination systems, operational safety analysis and review, and assessment of safety hazards related to their Range operations. They prepare or provide input to the Range Safety Approval or Range Safety Operational Plans, as required for each mission.

The Lead Range (in this case, AFFTC) for UAV testing interfaces with the UAV Project Office (Customer) using the RCC Universal Documentation System approach to identify and document all test support requirements, range support capabilities and operational requirements and directives. During this process, the support range(s) (Sea Test Range or Nevada Test and Training Range) will be involved with the planning/approval process to determine their roles and responsibilities in support of the test mission and will provide inputs and coordinate on the test and safety plans requiring their support. The support ranges will then carry out their responsibilities as required in the operational plans during the conduct of the mission.

The NAWC-WD Range Safety Manual[14] contains the safety guidance and processes used at the Navy Sea Range. During the operation, Range Operations Control supports the UAV mission by clearing the operating areas, tracking and monitoring vehicle performance, ensuring in-flight safety of the test vehicle, and initiating flight termination if required. The Range Control Office provides surveillance and clearance, and real-time safety support, for all Range operations. The Test Conductor/Operations Conductor is the primary point of contact for intra/inter-range decisions while operations are in progress. The office also coordinates use of airspace with Air Route Traffic Controller Center and adjacent FAA Air Traffic Control Facilities. The Range Safety Officer, designated by the Range Safety Office, ensures operational safety for aircraft that enter into the Range. The Nevada Test and Training Range[15] have similar processes and procedures to support UAV testing missions to those described for NAWC-WD at the Sea Range.

7.0 REGULATIONS AND SAFETY PROCEDURES FOR UAVS IN CIVIL AIRSPACE

The FAA controls the use of the NAS. In the interest of public safety the FAA has developed several protocols to ensure that unsafe aircraft are not allowed to fly and endanger the public. Both civilian and military interests would like to operate UAVs within the NAS. The FAA has determined that UAVs currently do not fall within standard airworthiness regulations, and special regulations are needed to properly assess the level of safety involved in UAV operations. These special procedures are difficult to complete, can have very severe flight limitations and are time consuming, taking at least 60 days to obtain. Efforts are ongoing to either modify or expand existing regulations so that UAV flights are routine with the eventual goal of being able to fly the same day the flight plan is submitted. This quick turn around is called “file-and-fly” and is the current standard for certified manned aircraft. The next section covers the current FAA regulations for aircraft certification. That will be followed by the current FAA requirements for UAVs to fly in the civil airspace, called the National Airspace System (NAS).

7.1 GENERAL FAA AIRWORTHINESS CERTIFICATION

A FAA airworthiness certificate, a.k.a. type certificate, is required for any aircraft intended for flight in United States airspace. The “type” of the aircraft is the general category that best fits the aircraft from the

---

[14] Pacific Ranges and Facilities Department, *Range Safety Manual, September 1999*

[15] Air Force Instruction 13-212, Volume 1, *Space, Missile, Command, and Control – Range Planning and Operations, 7 August 2001*

following list: normal, utility, acrobatic, commuter, transport, manned free balloons and special classes. Each type category has a certain set of performance and design criteria that must be met in order for the aircraft to be certified. The type certificate extends to all aircraft identical to the original aircraft design for which the certificate was issued.

New aircraft designs must be proven to have an "equivalent level of safety" to FAA standards for the type in order to receive airworthiness certification. In September 2004 the FAA release a document called Certification Process Improvement (CPI)[16] to assist industry with filing applications for product certification. The certificate regulations are spelled out in Orders 8110.4 and Title 14 Code of Federal Regulations (CFR) part 21 subpart B (21.11 to 21.53). The CPI sets up a process where the manufacturer and the FAA get together and create a Partnership for Safety Plan (PSP) and a Project Specific Certification Plan (PSCP). The PSP is an “umbrella agreement between the FAA and the Applicant that defines generic procedures to plan for product certification.” While the PSCP “captures procedures based on the generic methodologies of the PSP and applies them to a specific project.” During the application process there are design reviews, vehicle inspections, ground tests, functional and reliability tests, conformity inspections, and a flight manual review before operational limitations can be defined and a final certification decision is made. An airworthiness certificate will allow a “file-and-fly” protocol for the aircraft.

In addition to having an airworthiness certificate, certain flight plan limitations for the aircraft can apply. Two important concerns that could lead to restrictions are the allowable airspace and acceptable weather conditions. Both of these concerns have requirements on the aircraft’s design and equipment.

During flight there are two sets of flight rules that are used depending on the weather conditions. These are Instrument Flight Rules (IFR) and Visual Flight Rules (VFR). IFR is used whenever the weather is severe enough to impair the pilot’s view or in specified airspaces. These different rules dictate procedures for navigation, take-off, landing and separation of air traffic depending on how much the aircraft’s pilot can be expected to see. IFR requires that the aircraft be equipped with the necessary equipment and that the pilot be specially trained to handle these conditions. VFR apply when weather conditions are good enough for a pilot of a manned aircraft to see hazards effectively and is less restrictive than IFR, requiring only a standard pilots license. These flight rules are included in UAV “see and avoid” requirements and are often set when the flight plan is submitted.

---

[16] Prepared by AMA. GAMA, and FAA Aircraft Certification Services, *The FAA and Industry Guide to Product Certification, Second Edition, September 2004.*
www.faa.gov/licenses_certificates/aircraft_certification/design_approvals/

The CFR part 71 defines 6 different airspace classes and the associated protocols required in order to safely operate in these regions. Class B, C, and D are the airspaces surrounding large, medium and small airports, respectively. Classes A, E, and G are general use airspaces and are described as follows:

- Class A airspace is from 18,000 ft above Mean Sea Level (MSL) to 60,000 ft MSL. Aircraft are required to be equipped with transponders and are controlled by ATC at all times. All flights are required to operate be under IFR.
- Class E airspace extends from 1200 ft Above Ground Level (AGL) or 14,500 MSL until it meets a higher airspace, typically Class A. It starts again at 60,000 ft MSL and above. The aircraft can fly under IFR or VFR.
- Class G airspace is "uncontrolled" airspace and covers the range of altitudes between the ground and class E airspace. It is uncontrolled airspace and a flight plan is not needed to operate in the region. ATC does not control aircraft in this airspace.

7.2 CURRENT FAA REGULATIONS FOR UAVS IN THE NAS

Regulations for UAV operations within the NAS are different depending on if the mission is vital to the public (i.e. important to "National Security"). The FAA has established protocols and regulations for both vital public and common operations. Vital public operations require an application for a Certificate of Waiver or Authorization (COA) to avoid the requirements for standard airworthiness certification. Other UAV operations are currently directed to obtain a special airworthiness certificate called an Experimental Airworthiness Certificate (EAC). These procedures required for both of these methods are outlined and described in Section 7.3 and Section 7.4 respectively.

UAV operations do not fall under current FAA manned aircraft regulations because there is no standard type category that is comparable. An equivalent level of safety to current types is unattainable due to reliability and technological issues. There are two areas of concern to UAV operations that need to be addressed before UAVs can reasonably be brought under current FAA regulations. These areas are vehicle reliability and "see-and-avoid" capabilities.

UAV reliability has improved significantly as many vehicle types have been flown in excess of 100,000 flights; thus providing a larger database for reliability estimation. A sub-category of vehicle reliability of particular interest to the FAA is the reliability of the control/data link between the UAV and the operator[17]. In addition to having a reliable control link, the UAV also needs an effective contingency

[17] Charlotte Adams, *FAA's Cautious View of UAVs*, Avionics Magazine, *September 2005*.

procedure should the data link be lost. Example procedures include: returning the aircraft to its point of origin, circling until the data link can be reestablished, ditching into a predefined location, or the use of a destruct or other flight termination system.

"See-and-avoid," also called "sense-and-avoid," is an essential part of FAA general operating and flight rules. In particular CFR part 91.113 where, included within the right-of-way rules, it states "vigilance shall be maintained by each person operating an aircraft so as to see and avoid other aircraft." UAV operators are required to be aware of other aircraft and avoid mid-air collisions just as a manned aircraft pilot would be. This usually requires the use of land based observers and chase aircraft because most UAV optic and/or control systems are not yet sophisticated enough by FAA standards to adequately handle see and avoid responsibility. There is also the issue of data link latency. Data link latency is the time lost from the moment the UAV senses the other aircraft, sends a signal to the operator, the operators response in sending a signal back, and finally the UAVs response to the operators commands. At aircraft flight speed, seconds can sometimes make the difference.

OSD has set a standard for sense-and-avoid capabilities in an effort to assist UAV integration into the NAS[18]. "The standard for sense-and-avoid systems is to find and avoid traffic conflicts within plus or minus 110 degrees in azimuth measured from the longitudinal axis and plus or minus 15 degrees in elevation from the cruise speed level line." In other words, the UAV should see aircraft within 110 degrees to the left or right and 15 degrees up and down from the nose of the UAV. In addition to sensing the other aircraft, the correct course change must also be determined and executed. For example, some current aircraft are equipped with Traffic alert and Collision Avoidance System (TCAS), which monitors transponder-equipped aircraft, and makes suggestions to the pilots based upon the traffic in the area to avoid collisions.

7.3 FAA CERTIFICATES OF WAIVER OR AUTHORIZATION (COA)

The United States military has long held a separate airworthiness certification process detailed in Air Force Policy Directive 62-6. Typically the military airworthiness certification also fulfills FAA criteria for airworthiness and the FAA will allow aircraft with these certificates to fly into civil airspace. Some military or civil government aircraft do not meet military or FAA airworthiness certification guidelines but are needed for "National Security." A policy exists which allows the government to apply for a COA. A COA, if accepted by the FAA, allows the government to operate the aircraft in the NAS under limited

[18] Office of the Secretary of Defense, *Airspace Integration Plan for Unmanned Aviation, November 2004.*

conditions. For every government UAV operation that is to leave restricted airspace the government applies for a COA.

A COA is currently the standard method used for certifying UAV flight in the NAS. A COA is similar to an EAC used by civilian operators in that there are many restrictions. The FAA recently released a memorandum[19] detailing the policies by which a COA application should be judged and what restrictions should be considered. Under a COA the UAV has to comply with FAA regulations concerning 'General Operating and Flight Rules.'[20] A COA does not exempt the user from local or state ordinances that may need to be addressed.

FAA Order 7210.3 describes the COA and spells out the general requirements and responsibilities involved. All COA applications must be submitted at least 60 days prior to the commencement of operations. A COA is issued to the requesting organization, whenever possible, not the individual acting on behalf of the organization. It will specify the operations that are permitted and define the area and altitudes at which the aircraft can fly. The COA gives the first effective and expiration dates and the allowed hours of operation but can include alternate dates in case of cancellation due to weather problems. In general, the COA Administrator should tailor the COA to restrict the operations to only what is needed and can include any extra precautions the COA Administrator deems necessary.

The military UAV COA application description, regulations and organization responsibilities are in FAA Order 7610.4K Section 9. The applicant must include the following information within a COA application:

1. Detailed description of the intended flight operation including what airspace is to be used.
2. Aircraft physical characteristics.
3. Flight performance characteristics.
4. Method used to pilot the vehicle and see and avoid other air traffic.
5. Coordination procedure between the UAV operators and Air Traffic Control (ATC).
6. Communication procedures.
7. Route and altitude procedures.

---

[19] Federal Aviation Administration Memo AFS-400 UAV Policy 05-01, *Unmanned Aircraft Systems Operations in the U.S. National Airspace System – Interim Operational Approval Guidance, September 2005*

[20] CFR part 91

8. Lost data link/mission abort procedures and flight termination procedures.

9. A statement from the organization stating that the vehicle is airworthy.

In addition to the document submittal requirements, there are aircraft equipment and operational requirements as follows:

1. UAV should be equipped with standard aircraft anti-collision lights.

2. Equipped with an altitude encoding transponder.

3. Instantaneous two-way radio communication with the ATC facilities is required.

4. Compliance with all ATC clearances is mandatory.

5. UAV users are responsible at all times for collision avoidance maneuvers with nonparticipating aircraft -- UAV must yield to all other aircraft.

The FAA policy memorandum mentioned above, AFS-400 UAV Policy 05-01, is intended to assist COA Administrators in reviewing UAV applications. The document includes requirements and recommendation particular to UAV operations. The primary concern is for see-and-avoid capabilities. For UAV applications it is required that the applicant show that midair collisions are "extremely improbably." Studies required in the application must include a hazard analysis, risk assessment and other appropriate documentation to support the "extremely improbably" conclusion. Furthermore, a copy of the civil or military airworthiness certifications is needed, or if one is not available, then "information explaining how an airworthiness determination was made" [21]. Special analysis is required to specifically address any hazards from dropped or sprayed substances. Additional special analyses are needed if the vehicle is intended to operate in or around densely population areas.

COA for UAV flights place specific limitations on the operation depending on the airspace used.

- Below 18,000 ft MSL (Class E and G airspace)
  - IFR need ATC clearance, must be equipped with a transponder, maintain direct two-way communication with ATC (preferably relayed through the UAV) and visual observers as per policy
  - Operating under VFR requires either airborne or ground based visual observers. Radar alone is not sufficient. The vehicle must be equipped with a transponder

[21] FAA Policy Memorandum AFS-400 UAV policy 05-01. Section 6.3.1

and pre-coordination with ATC is required. The transponder is not required if the UAV remains less than 400 ft above ground level with a visual observer. Direct two-way communications must be maintained if requested by ATC.

- Between 18,000 ft and 60,000 ft MSL (Class A airspace)
  - The UAV must have sufficient performance characteristics to not impede normal air traffic operations.
  - The UAV must use IFR, obtain clearance from ATC, have radar track for the duration of flight in Class A airspace, must be equipped with a transponder, maintain direct two-way communication with ATC preferably relayed through the UAV
- No policy is in place for flights above 60,000 ft MSL.
- In FAA controlled oceanic airspace the UAV needs to operate under IFR, have clearance from ATC and maintain two-way communications.

FAA policy outlines the requirements for UAV pilots under a COA. UAV pilots must know the FAA right-of-way regulations and have the necessary experience to maintain direct and accurate communication with the appropriate ATC through out the duration of the flight. Also a UAV pilot must hold a valid FAA airman medical certificate and be free of alcohol and drugs as per CFR 91.17. A pilot can be crew to only one UAV at a time. The UAV pilot is as responsible for controlling the UAV, as a manned aircraft pilot would be. They are responsible for a thorough preflight airworthiness inspection. When operating under a VFR flight plan beyond the pilot's visual line-of-sight the pilot "must pass the required [aeronautical] knowledge test for a private pilot certificate." [22] The pilot for a UAV intended for flight plans using IFR must hold a pilots license. These pilots must also have the appropriate instrument rating for the conditions.

At all times a Pilot-in-Charge (PIC) must be designated for the UAV. The PIC is responsible for the safety of the UAV and any people or property, which may come into contact with the UAV. The PIC must have a number of recent experiences operating the UAV; more experience is needed if planning to fly under IFR.

The FAA policy identifies that most optical or sensor systems on UAVs are designed for viewing the ground. The cameras and sensors on the aircraft cannot be the sole see-and-avoid capability during flight.

[22] Federal Aviation Administration, Policy Memorandum AFS-400 UAV policy 05-01. Section 6.17.3

Therefore, observers are needed to communicate with the UAV pilot about any problems or other nearby aircraft. These observers can be airborne in chase aircraft or on the ground. Both types of observers must be devoted observers and cannot share in other tasks such as piloting the chase aircraft, piloting the UAV or monitoring the radar. The observer(s) "must keep visual contact with the UAV at all times." [23] All observers need to be within one-mile lateral/horizontal distance and 3000 ft of elevation of the UAV at all times.

Each observer, radar monitor or sensor operator must be in direct communication with the PIC of the UAV and have sufficient training in FAA right-of-way regulations and aircraft control procedures to be able to efficiently communicate course corrections with the pilot. Additionally all observers, radar monitors and sensor operators must be trained and familiar with their equipment to quickly and accurately monitor the UAV. The observers' primary responsibility is to ensure that the UAV avoid other aircraft, obstructions, and in particular, a hard to spot airborne object not easily identifiable by Radar such as balloons, gliders, and skydivers. In this regard the observers act as the see-and-avoid capabilities of the UAV. In addition to the FAA regulation training mentioned above, the observer must hold " a current third class (or higher) airman medical certificate that has been issued under 14 CFR 67." [24] Observers are held to the same standard of alcohol and drug usage as a manned aircraft pilot.

COAs are typically applied for and granted for a particular flight or a handful of flights that are closely related. The Global Hawk UAV is an exception and received a "National COA" in August of 2003. This National COA was issued to the Air Force for Global Hawk operations in the NAS. The COA allows Global Hawk missions to file flight plans more quickly without needing to file a full COA application for each mission. This has reduced submittal time for an operation from "60 [days] to as short as 5 days." [25] The COA requires that the aircraft be unarmed.

7.4 FAA SPECIAL AIRWORTHINESS CERTIFICATION

The FAA has protocols for an airworthiness certificate for unique or non-standard aircraft called a "Special Airworthiness Certificate." An EAC is one category of these special certificates. The different categories of special airworthiness certificates are described in Order 8130.2F Chapter 4 and CFR section 21.191. For non-government civilian UAV users, the FAA requires an EAC to fulfill the airworthiness requirement. As of September 2005 the FAA has received seven applications for EACs to operate UAV

[23] Federal Aviation Administration, Policy Memorandum AFS-400 UAV policy 05-01. Sections 6.4 & 6.20

[24] Federal Aviation Administration, Policy Memorandum AFS-400 UAV policy 05-01. Section 6.16

[25] Sue Baker, *AFMC News Service Release 0839. August 21, 2003*

in civil airspace. An EAC is by no means a standard airworthiness certificate because there are still many limitations in place to protect the public. Under an EAC the aircraft is limited to the number of flight plans stated in the EAC. There are special requirements for the maintenance and upkeep of the aircraft, and for the training and experience of the pilots and observers.

The regulations (CFR 21.193) require that an applicant for an EAC submit the following information to the FAA:

1. A statement stating the purpose for which the aircraft is to be used.
2. Enough data (including photographs) to identify the aircraft.
3. Upon inspection of the aircraft, any pertinent information found necessary by the Administrator to safeguard the general public.
4. In the case of an aircraft to be used for experimental purposes a Program Letter addressing:
   a. The purpose of the experiment.
   b. The estimated time or number of flights.
   c. The areas over which the experiment will be conducted.
   d. Three-view drawings or three-view dimensional photographs of the aircraft.

EAC regulations[26] list a variety of operational limitations. For example: staying within the predefined test area, no flights over densely populated areas, no flights in a congested airway, and the pilot must hold an appropriate category/class rating. A UAV EAC would most likely include a chase plane and ground based observers. The certificate Administrator has the option of limiting the flight conditions to VFR day only, VFR day or night, or IFR if the aircraft is properly equipped. EACs are generally issued for only the length of time reasonable to accomplish the applicant's program, not to exceed one year.

There is another option available for obtaining FAA approval for small UAVs that operate very similar to Remote Controlled (RC) model aircraft. It has been suggested that this category of UAV could be using the same FAA regulations as hobby RC model aircraft. There are no FAA regulations for RC model aircraft; there are instead some recommendations in Advisory Circular (AC) 91-57. FAA policy suggests that UAV flights, that follow the guidance of AC 91-57 and never leave the line of sight of the operator,

[26] Federal Aviation Administration, Order 8130.2F Section 166

can be considered model aircraft and therefore do not need special certification. However, this category of UAV is not likely to be tested outside of the current assigned restricted airspace.

7.5 PROPOSED FUTURE REGULATION CHANGES

The integration of UAV operations into the NAS is an ongoing study and planning effort. There are several organizations working on improving the FAA regulations for UAV usage of the NAS. The DoD has created a "UAV Roadmap[27]" and an UAV Integration study[28] to define their goals and requirements for operating military UAV in the NAS.

A coalition of industry and government agencies, including DoD and NASA, called "Access 5" are collectively working with the FAA on approaches and regulations to incorporate UAVs into the civil airspace by starting with regulations for High Altitude Long Endurance (HALE) UAV. A similar European organization is actively evaluating the use of International airspace for UAV operations.

8.0 SUMMARY

UAV flight tests are conducted on the Edwards Flight Test Range within the assigned restricted and shared airspace as part of the UAV research and development process. The processes and procedures outlined in the AFFTC safety and operations Instructions (regulations) and the RCC documents on range safety criteria provide the direction and guidance for UAV flight safety planning and operations. When flights are extended through civil airspace to nearby restricted airspace over other test ranges (i.e. Nevada Test and Training Range at Nellis AFB and the Sea Range at Point Mugu), all applicable FAA certifications and restrictions must be met. There are several factors that are considered to establish the UAV vehicle configuration and operational restrictions required to minimize the risks to people and property. Safety criteria must be met for the UAV maturity level (e.g. from prior testing), communications with the pilot and air traffic control, emergency plans such as alternate landing sites and flight termination systems, and midair collision avoidance capabilities. UAV pilots must meet strict training and experience requirements.

UAV test flight safety planning and operations is very similar to that for manned aircraft testing. The AFFTCI 91-5, AFFTC Test Safety Review Process, directs the same safety planning, review and approval process for both test manned aircraft and UAVs. Likewise, the AFFTCI 11-1, Flying Operations, guidance applies to both manned aircraft and UAV flight operations with additional guidance contained in

[27] Office of the Secretary of Defense, *Unmanned Aircraft System (UAV) Roadmap 2005-2030*

[28] Office of the Secretary of Defense , *Airspace Integration Plan for Unmanned Aviation, November 2004*

Chapter 15 of AFFTCI 11-1 to account for UAV unique characteristics and operating procedures. The hazard analysis and risk assessment methodologies are also generally the same as for manned test aircraft, with additional specific guidance provided in the RCC Document 323-99, Range Safety Criteria for Unmanned Air Vehicles.

The FAA policies exist for permitting UAV test flights within the National Airspace System (NAS). At this time FAA allows a waiver, to satisfy its standard requirements for government UAV flights, called a Certificate of Authorization (COA), with specific documentation requirements and restrictions. This process is very difficult and slow. Private experimental aircraft approvals for flights within the NAS can be authorized with an FAA Experimental Airworthiness Certificate (EAC). There are ongoing initiatives by the DoD, NASA, Department of Homeland Security and private industry, working with the FAA, to develop the requirements, including UAV system capabilities, necessary to integrate UAV airworthiness certification regulations into the FAA Rules.

9.0 DOCUMENT PREPARATION

This document was prepared by ACTA Inc. and Tetra Tech, Inc. under U.S. Army Corps of Engineers Contract No. DACA05-01-D-0005, Task Order 067.

This page intentionally left blank.

C NATURAL RESOURCES

C.1 SUPPLEMENTAL NATURAL RESOURCES DATA FOR R-2508 COMPLEX, R-2515 AND EDWARDS AFB

C.1.1 R-2508 Complex and High-Altitude Supersonic Corridor

The plant communities present within the R-2508 Complex and High-Altitude Supersonic Corridor (HASC) in California include Mojave Desert, coniferous forests, alpine/subalpine, foothill grassland, foothill woodland, and scrub. These are described in the following paragraphs. Certain species occur in virtually every natural habitat. Many of the common and widespread plant species are associated with the habitats described below. However, some invasive plants such as Russian thistle (*Salsola tragus*), red brome (*Bromus matritensis ssp. rubens*), tansy mustard (*Descurainia pinnata*), and split grass (*Schismus barbatus*) are common in disturbed portions of natural habitats. Other exotic species have become established in more natural areas, such as tamarisk or salt-cedar (*Tamarix* spp.).

C.1.1.1 Mojave Desert Plant Communities

Mojave Desert plant communities include creosote bush scrub, Joshua tree woodland, arid-phase saltbush scrub, halophytic-phase saltbush scrub, lake beds, and mesquite woodlands. These communities contain species that are adapted to the xeric environments of the Mojave Desert. Creosote bush scrub is dominated by creosote bush (*Larrea tridentata*) and supports relatively high plant diversity. Common associated plant species include burrobush (*Ambrosia dumosa*), winterfat (*Krascheninnikovia lanata*), cheesebush (*Hymenoclea salsola*), and Nevada tea (*Ephedra nevadensis*).

Joshua tree woodlands essentially occur within a variety of habitats, but are especially common in creosote bush scrub. The dominant species are the same as the “host” community, with the addition of Joshua tree (*Yucca brevifolia*). Joshua trees provide vertical structure to the habitat, which offers additional foraging and denning/nesting opportunities for wildlife. The understory supports a high diversity of animal species including the native desert dandelion (*Malacothrix glabrata*), pincushion (*Chaenactis* spp.), and fiddleneck (*Amsinckia tesselata*).

Arid-phase saltbush scrub is found in the most arid areas, and is dominated by allscale (*Atriplex polycarpa*). Burrobush, goldenhead (*Acamptopappus sphaerocephalus*), and cheesebush are common associates of this community. Other species that may be found in this vegetation type include Nevada tea, desert alyssum (*Lepidium fremontii*), cheesebush, goldenhead, wolfberry (*Lycium andersonii*), spiny hop-sage (*Grayia spinosa*), and bud sage (*Artemisia spinescens*).

Halophytic-phase saltbush scrub occurs in narrow bands along dry lakebeds and in claypan and dune complexes. This habitat occurs in high-pH soils, and is dominated by plant species adapted to tolerate these conditions. Common plant species of halophytic-phase saltbush scrub include shadscale (*Atriplex confertifolia*), alkali goldenbush (*Isocoma acradenia* ssp. *acradenia*), and rubber rabbitbush (*Chrysothamnus nauseosus*). The understory is composed primarily of kochia (*Kochia californica*), wild rye (*Elymus cinereus*), saltgrass (*Distichlis spicata*), goldfields (*Lasthenia californica*), and alkali pineappleweed (*Chamomilla occidentalis*).

Although essentially devoid of vegetation (except at the edges), lakebeds and other ephemeral bodies of water are an important environment for wildlife. Composed of clayey soils, this habitat type includes playas, claypans, and lakebeds. These features vary in size and morphology, and support a unique fauna adapted to seasonal inundation and desiccation. Birds, especially wading birds and waterfowl, are attracted to these areas during winter and spring migrations when inundation takes place.

Mesquite woodlands, a relatively spatially restricted habitat on Edwards Air Force Base (AFB) and the Mojave Desert, occur on more mesic washes and drainages. As with Joshua tree woodlands, the dominant species in mesquite woodlands are mesquite (*Prosopsis glandulosa*), with an understory comprising dominants found in the “host” plant community. Mesquite woodlands also provide vertical structure to the habitat, which is important to wildlife.

C.1.1.2 Coniferous Forest Plant Communities

Several coniferous forest types occur in the Sierra Nevada Range including red fir forest, yellow pine forest, mixed coniferous forest, and pinyon- juniper woodlands. Red fir forests are dominated by red fir (*Abies magnifica*), Jeffrey pine (*Pinus jeffreyi*), western white pine (*Pinus monticola*), lodgepole pine (*Pinus murrayama*), snow bush (*Ceanothus cordulatus*), bush chinquapin (*Chrysolepis sempervirens*), and quaking aspen (*Populus tremuloides*). Red fir forests are found at high elevations, between 8,000 and 9,000 feet.

Yellow pine forests are dominated by ponderosa pine (*Pinus ponderosa*), sugar pine (*Pinus lambertiana*), white fir (*Abies concolor*), big-cone spruce (*Pseudotsuga macrocarpa*), black oak (*Quercus kellogii*), and various shrub species. Yellow pine forests occur at mid-elevations, between 5,000 and 8,000 feet. Mixed conifer forests have variable species composition, but occur between the upper limits of yellow pine and the lower limits of red fir forests.

Pinyon-juniper woodlands occur between 5,000- and 8,000-foot elevations on drier mountain slopes. They comprise sparse stands of single-leaf pinyon pine (*Pinus monophylla*) and various juniper species (Juniperus spp.). Shrubs and perennial bunch grasses are often interspersed between the sparse stands of the dominant pinyon and juniper trees.

C.1.1.3 Alpine/Sub-alpine Plant Communities

Alpine/sub-alpine plant communities include sub-alpine forests and alpine habitats. Sub-alpine forests are dominated by high-elevation pines such as white bark pine (*Pinus albicaulis*), foxtail pine (*Pinus balfouriana*), limber pine (*Pinus flexilis*), lodgepole pine, mountain hemlock (*Tsuga mertensiana*), and various shrub species. Generally a comparatively low-growing and sparse woodland community, subalpine forest is limited to a few scattered localities above elevations of 9,500 feet.

Alpine habitats, also referred to as fell fields, occur at the uppermost vegetated elevations. Alpine habitats are generally dominated by a variety of low-growing herbaceous species such as sedge (*Carex* spp.) and draba (*Draba* spp.), with astragalus (*Astragalus* spp.), Indian paintbrush (*Castilleja* spp.), and penstemon (*Penstemon* spp.) comprising the common wildflowers. Fescues (*Vulpia* spp.) and bluegrasses (*Poa* spp.) are common grasses found within alpine habitats.

C.1.1.4 Foothill Grassland Plant Communities

Foothill grasslands, also known as Valley grasslands, are dominated by various grass species. This low-growing, herbaceous community is limited to the lower elevations of the western Sierra Nevada Range and the San Joaquin Valley. Prior to European settlement and widespread cultivation and urbanization of the San Joaquin Valley, the species composition of these grasslands primarily consisted of native annual and bunch grasses. Currently, native grass populations are sparsely distributed among what are predominantly non- native annual species such as brome grasses (*Bromus* spp.), oats (*Avena* spp.), barley (*Hordeum* spp.), split grass (*Schismus barbatus*), filaree (*Erodium* spp.), and mustard (*Hirschfeldia incana* and *Brassica* spp.). Natives include annual flower species such as goldfields (*Lasthenia* spp.), gilia (*Gilia* spp.), California poppy (*Eschscholtzia californica*), phacelia (*Phacelia* spp.), owl's clover (*Orthocarpus* spp.), and Indian paintbrush, and native grasses of various genera (e.g., *Achnatherum* spp. and *Poa* spp.).

C.1.1.5 Foothill Woodland Plant Communities

Foothill woodlands are dominated by oaks at lower elevations and certain pines at their upper elevations on the western side of the Sierra Nevada Range. A grassland understory is characteristic of this

community. Oak species found in this habitat include coast live oak (*Quercus agrifolia*), canyon oak (*Quercus chrysolepis*), blue oak (*Quercus douglasii*), interior live oak (*Quercus wislizenii*), and valley oak (*Quercus lobata*). California bay (*Umbellaria californica*), currant (*Ribes* spp.), ceanothus (*Ceanothus* spp.), and buckthorn (*Rhamnus* spp.) are other foothill woodland component species.

C.1.1.6 Scrub Plant Communities

Various non-desert scrub communities are also common in this area. Scrub communities include shadscale scrub dominated by shadscale; chaparral dominated by chamise (*Adenostoma fasciculatum*), buckwheat (*Eriogonum fasciculatum*), toyon (*Heteromeles arbutifolia*), manzanita (*Arctostaphylos* spp.), and ceanothus (*Ceanothus* spp.); and sage-grass (also known as sagebrush grassland) dominated by Great Basin sagebrush (*Artemisia tridentata*), blackbrush (*Coleogyne ramosissima*), rabbitbrush (*Chrysothamnus* spp.), and antelopebush (*Purshia glandulosa*).

C.2.2.3 Plants at Edwards AFB

The five major plant communities at Edwards AFB are creosote bush scrub, Joshua tree woodland, halophytic phase saltbrush scrub, xerophytic saltbrush scrub, and mesquite woodland (Figure C-1).

Creosote bush scrub is dominated by creosote bush (*Larrea divaricata*). At Edwards AFB, there are approximately 103,000 acres of creosote bush scrub, which comprises approximately 34 percent of the base area. Creosote bush scrub is distributed throughout the northwestern and eastern portions of the base and supports the highest plant diversity on base (AFFTC 2002). Common species found in this community include winterfat (*Ceratoides lanata*), cheesebush (*Hymenoclea salsola*), and Nevada tea (*Ephedra nevadensis*).

Joshua tree woodland is dominated by Joshua trees (*Yucca brevifolia*) and is most prevalent east of Rogers Dry Lake, with small patches occurring in the northwest. At Edwards AFB, there are approximately 52,800 acres of Joshua tree woodland, which comprises approximately 17 percent of the area of the base. Common species found in this community include the native desert dandelion (*Malacothrix glabrata*), pincushion (*Chaenactis* sp.), and fiddleneck (*Amsinckia tesselata*).

Halophytic phase saltbrush scrub is dominated by four species of the genus *Atriplex*: spinescale (*A. spinifera*), shadescale (*A. confertifolia*), four-wing saltbush (*A. canescens*), and quailbush (*A. lentiformes*). At Edwards AFB, there are approximately 55,300 acres of halophytic phase saltbush scrub,

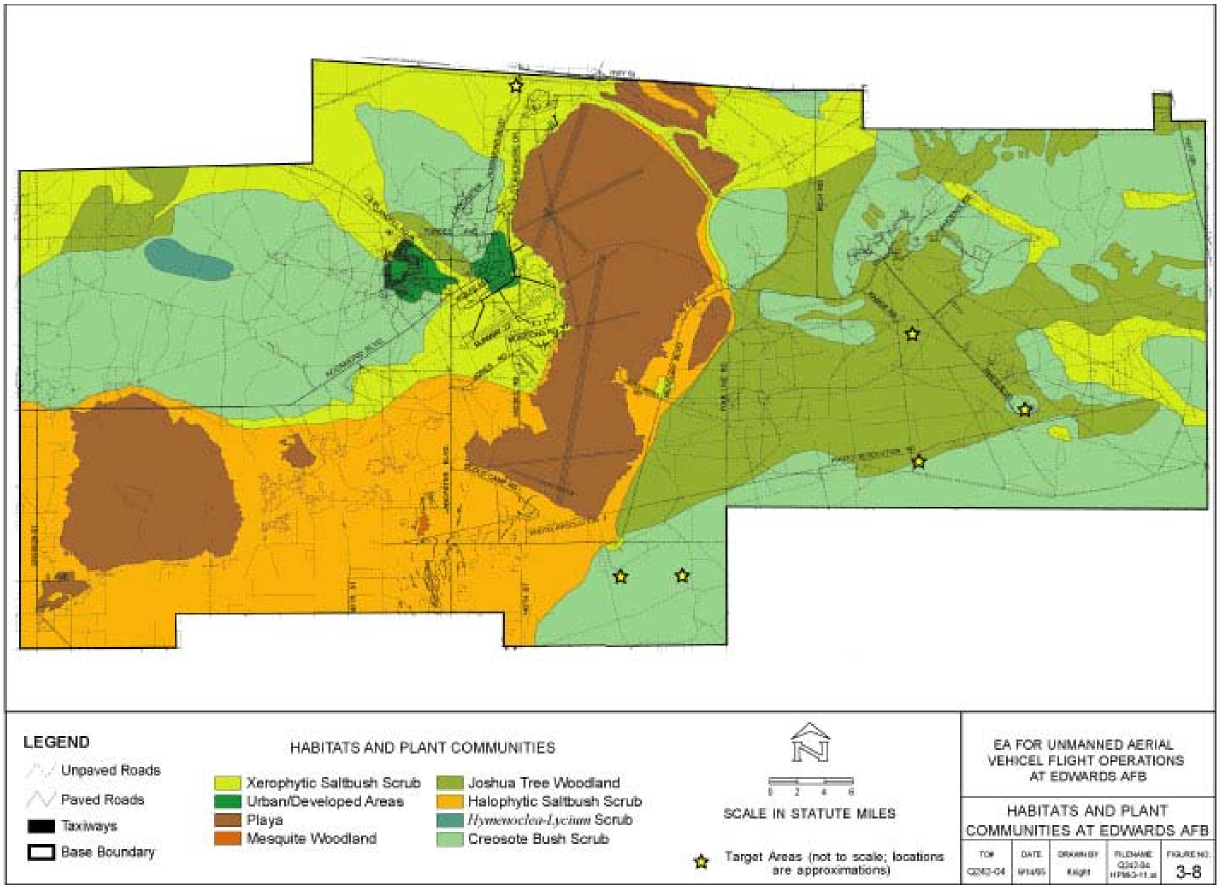


Figure C-1

Habitat and Plant Communities at Edwards AFB

which comprises approximately 18 percent of the area of the base. A common species found in this community includes saltgrass (*Distichlis spicata*).

Arid phase saltbrush is dominated by allscale (*Atriplex polycarpa*). At Edwards AFB, there are approximately 45,300 acres of arid phase saltbush scrub, which comprises approximately 15 percent of the area of the base. Common species found in this community include burrobush (*Ambrosia dumosa*), goldenhead (*Acamptopappas sphaerocephalus*), and cheesebush (*Hymenoclea salsola*).

Sensitive Plant Species

Studies of sensitive plants at Edwards AFB indicate that no federal or state-listed plant species have been identified on base. Nine species that are listed by the California Native Plant Society (CNPS), however, have been identified on base. Four of these plants are Barstow woolly sunflower (*Eriophyllum*

mohavense), desert cymopterus (*Cymopterus deserticola*), alkali mariposa lily (*Calochortus striatus*), and yellow spiny cape (*Goodmania luteola*).

C.2.2.3 Wildlife

Wildlife species occurring within the ROI include those adapted to a variety of habitats. Several federally and state-protected species that may be found within the ROI are discussed in the Threatened and Endangered Species section.

Wildlife within the Mojave Desert includes native species including kangaroo rats (*Dipodomys* spp.), western pipistrelle (*Pipistrellus hesperus*), little brown bat (*Myotis lucifugus*), desert woodrat (*Neotoma lepida*), deer mouse (*Peromyscus maniculatus*), coyote (*Canis latrans*), and bobcat (*Felis rufus*). Common birds include turkey vulture (*Cathartes aura*), common raven (*Corvus corax*), sage sparrow (*Amphispiza belli*), and western meadowlark (*Sturnella neglecta*). Reptiles common to all desert habitats include desert spiny lizard (*Sceloporus magister*), side-blotched lizard (*Uta stansburiana*), western whiptail (*Cnemidophorus tigris*), and zebra- tailed lizard (*Callisaurus draconoides*).

Birds are very mobile species and tend to occupy favored habitats within their range. Common bird species found within the Mojave Desert include red-tailed hawk (*Buteo jamaicensis*), killdeer (*Charadrius vociferus*), and white-crowned sparrow (*Zonotrichia leucophrys*). Large birds and bird flocks are known to present hazards to aircraft, typically below 5,000 feet in elevation, depending upon local terrain.

Amphibians typically found in coniferous forests include salamanders (*Batrachoseps* spp.), western toad (*Bufo boreas*), and mountain yellow-legged frog (*Rana muscosa*). Reptiles include Sierra alligator lizard (*Gerrhonotus coerulus*), rubber boa (*Charina bottae*), and western rattlesnake (*Crotalus viridis*). Bird species found throughout montane habitats in California include mountain chickadee (*Parus gambeli*), yellow-rumped warbler (*Dendroica coronata*), Clark's nutcracker (*Nucifraga columbiana*), and Williamson's sapsucker (*Sphyrapicus thyroideus*). Seasonal migrants include mountain bluebird (*Sialia currocoides*), dark-eyed junco (*Junco hyemalis*), and white-crowned sparrow (*Zonotrichia leucophrys*). Mammals commonly found in montane habitats include black bear (*Ursus americanus*), mountain lion (*Felis concolor*), and yellow-bellied marmot (*Marmota flaviventris*).

Amphibians typically found in foothill grasslands include western toad and Pacific tree frog (*Pseudacris regilla*). Reptiles include California whiptail (*Cnemidophorus tigris mundus*) and western rattlesnake (*Crotalus viridis*). Bird species found throughout San Joaquin grasslands include western meadowlark,

horned lark (*Eremophila alpestris*), yellow-billed magpie (*Pica nuttalli*), and white-tailed kite (*Elanus leucurus*). Seasonal migrants include western bluebird (*Sialia mexicana*) and white-crowned sparrow. Mammals commonly found in grassland habitats include coyote, long-tailed weasel (*Mustella frenata*), and California ground squirrel (*Spermophilus beecheyi*).

Amphibians and reptiles typically found in foothill woodlands include many of the same species found in other woodlands and grasslands. Bird species found in foothill woodland habitats include acorn woodpecker (*Melanerpes formicivorus*), northern flicker (*Colaptes auratus*), great-horned owl (*Bubo virginianus*), and bushtits (*Psaltriparus minimus*). Seasonal migrants include Hutton's vireo (*Vireo huttoni*), Bullock's oriole (*Icterus bullockii*), and lark sparrow (*Chondestes grammacus*). Mammals commonly found in foothill woodlands include mule deer (Odocoileus hemionus), bobcat, and California myotis bat (*Myotis californicus*).

Amphibians and reptiles typically found in scrub include toads (*Bufo* spp.), side-blotched lizard, and western fence lizard (*Sceloporus occidentalis*). Bird species found in scrub include scrub jay (*Aphelecoma coerulescens*), wrentit (*Chamea fasciata*), Bewick's wren (*Thryomanes bewickii*), and California thrasher (*Toxostoma reduvivum*). Mammals commonly found in scrub include brush rabbit (*Sylvilagus bachmani*), gray fox (*Urocyon cineroargentinus*), and light-footed woodrat (*Neotoma fuscipes*).

Threatened and Endangered Species

A number of federally and state-listed threatened and endangered animal species are known to be present in the ROI.

The desert tortoise (*Gopherus agassizii*) is one of three tortoise species of the genus Gopherus that occur in the United States. The species is geographically divided by the Colorado River into the Sonoran and Mojave populations. The Mojave population was formally listed as threatened by the USFWS in 1990. The desert tortoise is listed as threatened by the federal government and by the State of California. It can occur throughout the Colorado and Mojave deserts in elevations up to 4,100 feet, although ideal habitat typically occurs between 1,000 and 3,000 feet (Edwards AFB 2001). The desert tortoise can occur in almost every desert habitat, but is most common in desert washes, desert scrub, creosote bush, and Joshua tree habitats. This species finds cover in burrows that are usually under bushes and requires loose, dry, sandy soil for nest building. The desert tortoise is a herbivorous reptile whose native range includes the

Sonoran and Mojave deserts of southern California, southern Nevada, Arizona, extreme southwestern Utah, and Sonora and northern Sinaloa, Mexico.

Desert tortoises, known to occur within the ROI, prefer creosote scrub vegetation and firm soils for burrow construction. However, they can be found in other habitat types in relatively lower population densities. The highest densities of the desert tortoise are typically found in creosote scrub and Joshua tree woodlands, but saltbush-series vegetation also supports lower densities.

Fishes protected by endangered species regulations include the state- and federally listed as endangered Mohave tui chub (*Gila bicolor mohavensis*), Owens tui chub (*Gila bicolor snyderi*), and the Owens pupfish (*Cyprinodon radiosus*), and the state-listed as threatened cottonball marsh pupfish (*Cyprinodon salinus milleri*). The Mojave tui chub once inhabited the deep pools and slough-like areas in the Mojave River. Tui chub is the only fish native to that drainage. Populations of this fish have been transplanted to several places throughout the Mojave Desert, including the China Lake (within the R-2508 Complex). The Owens tui chub was formerly found throughout the Owens River basin in weedy shallows of spring-fed ponds and streams. Today they are found in only a few locations including a spring near Owens Dry Lake. Owens pupfish were formerly found in the Owens River system but are now found in only a few springs and ponds. The cottonball marsh pupfish is restricted to the Cottonball Marsh in Death Valley (Air Force Center for Environmental Excellence 2001).

The federally listed as threatened western snowy plover (*Charadrius alexandrinus nivosus*) inhabits shores of ephemeral lakes and perennial waters of the desert, and has been recorded at Rosamond Dry Lake on Edwards AFB and at Harper Dry Lake and Koehn Dry Lake (Air Force Center for Environmental Excellence 2001). The federally listed as threatened and the state-listed as endangered bald eagle (*Haliaeetus leucocephalus*) may winter near larger water bodies in the southern portion of the R-2508 Complex, including Harper Dry Lake. The federally listed as endangered and state-listed as threatened Yuma clapper rail (*Rallus longirostris yumanensis*) is a resident in shallow, freshwater marshes with dense stands of cattails and bulrushes. It has been recorded in the marsh of Harper Dry Lake (Air Force Center for Environmental Excellence 2001). The federally and state-listed as endangered Least Bell's vireo (*Vireo bellii pusillus*) is restricted to riparian areas containing dense willow thickets; its breeding range in the ROI is restricted to an area along the Amaragosa River. The Inyo California towhee (*Pipilo crisallis eremophila*) inhabits only the Argus Mountains of southern Inyo County. This federally listed as threatened and state-listed as endangered species requires dense willow and scrub habitat.

The Amaragosa vole (*Microtus californicus scirpenis*) is a small rodent that inhabits the Amaragosa River drainage; it is federally and state listed as endangered. Several other species of concern may occur in the Mojave Desert portion of the ROI, including the state-threatened Mohave ground squirrel (*Spermophilus mohavensis*).

Two federally listed as threatened fish species occur within the Sierra Nevada portion of the ROI. Little Kern golden trout (*Oncorhynchus aquabonita whitei*) inhabits the Little Kern River tributary of the Kern River. The Lahontan cutthroat trout (*Oncorhynchus clarki henshawi*) is a rare trout found on the eastern side of the Sierra Nevada.

One amphibian, the California red-legged frog (*Rana aurora draytonii*), a federally listed as threatened species, occurs in the foothill and montane portions of the Sierra Nevada. A state-listed as threatened reptile, the Southern rubber boa (*Charina bottae umbratrica*), inhabits an area west of Lake Isabella (Air Force Center for Environmental Excellence 2001). The American peregrine falcon (*Falco peregrinus anatum*) is state listed as endangered. This raptor (bird of prey) nests on cliffsides and on other rock outcrop areas. The great gray owl (*Strix nebulosa*) and willow flycatcher (*Empidonax trailii*) are listed as endangered by the state of California and occur in coniferous and willow riparian forests, respectively. Another state-listed as endangered bird, the western yellow-billed cuckoo (*Coccyzus americanus occidentalis*), occurs in riparian forests along the Kern River. It is also found in a small area along the Amaragosa River in the Mojave Desert.

California bighorn sheep (*Ovis canadensis californiana*), federally and state-listed as endangered, are residents of the most remote mountain wilderness areas within the ROI. Several species listed as threatened by the state of California occur within the Sierra Nevada portion of the ROI. The Kern Canyon slender salamander (*Batrachoseps stimatus*) is found only in the canyons of the lower Kern River. The wolverine (*Gulo gulo*) rarely resides in the remote high Sierra Nevada habitats. The Sierra Nevada red fox (*Vulpes vulpes necator*) is a seldom-seen nocturnal predator in this region.

Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) is a federally listed as threatened insect distributed within elderberry- dominated drainages throughout the San Joaquin Valley. The blunt-nosed leopard lizard (*Gambelia silus*) is both state- and federally listed as endangered, and occurs in sparsely vegetated plains and foothills. The Aleutian Canada goose (*Branta candensis leucopareia*) is a federally listed as threatened species that winters in the San Joaquin Valley. The San Joaquin kit fox (*Vulpes macrotis mutica*) is federally listed as endangered and state listed as threatened, and occurs in grasslands from Tracy south to southern Kern County. The giant kangaroo rat (*Dipodomys ingens*) and

Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*) are both state and federally listed as endangered species. The giant kangaroo rat occurs on or just outside the western limits of the R-2508 Complex in Kern County. The Tipton kangaroo rat once ranged throughout much of the southern San Joaquin Valley. Its populations are currently restricted to just several sites in the southern portion of that valley. State-listed species occurring in the ROI include the threatened San Joaquin antelope squirrel (*Ammospermophilus nelsoni*) found only in the southern San Joaquin Valley. Swainson's hawk (*Buteo swainsonii*) and bank swallow (*Riparia riparia*) are both listed as state threatened, and although uncommon, nest at sites throughout the San Joaquin Valley.

Kern primrose sphinx moth (*Euproserpinus euterpe*) is federally listed as threatened and is known only from a 5-acre area in the Walker Basin east of Bakersfield. The California condor (*Gymnogyps californianus*) is both federally and state listed as endangered but has been essentially extirpated from the wild. Efforts to reintroduce this species into the wild are currently underway. The Tehachapi slender salamander (*Batrachoseps stebbensi*) is state listed as threatened, with a distributional range that is restricted to an area between Piute Mountain and Tejon Pass.

Sensitive Habitats

Desert tortoise critical habitat is present within the ROI. Important habitat for desert bighorn sheep and species identified in the Threatened and Endangered Species section also occur within the ROI. Some pools and drainages are the only habitat for certain fish species, such as pupfish. Two sensitive ecological areas, as defined by the county of Los Angeles, occur within Edwards AFB: Piute Ponds, in the southwestern corner of the base, supports a significant number of waterfowl and provides a stopover area for migratory birds. Mesquite woodlands, in the south-central portion of Edwards AFB, provide a unique habitat for wildlife such as phainopepla (*Phainopepla nitens*) and loggerhead shrike (*Lanius ludovicianus*).

Five eubranchiopod shrimp species have been identified in Rogers Dry Lake: clam shrimp (*Eocyzicus digueti*), tadpole shrimp (*Lepidurus lemmoni*), and three species of fairy shrimp (*Branchinecta mackini*, *B. gigas*, and *B. lindahli*) (AFFTC 1992). Eubranchiopods lie dormant in the soil of dry lakebeds until flooding creates the aquatic habitat necessary to complete their life cycles. These shrimp are a food source for a variety of migratory shorebirds that congregate at Rogers Dry Lake when water is present.

To date, the only amphibians identified on base include the western toad (*Bufo boreas*), Pacific tree frog (*Hyla regilla*), red-spotted toad (*Bufo punctatus*), and African clawed frog (*Xenopus laevis*). These were

identified at Piute Ponds by U.S. Geological Survey biologists during a survey in 1997. The African clawed frog is a problematic introduced species that feeds on native wildlife, including other amphibians, small reptiles, and fish (AFFTC 1997c). Common reptiles on base include the desert spiny lizard (*Sceloporus magister*), side-blotched lizard (*Uta stansburiana*), western whiptail *(Cnemidophorus tigris)*, zebra-tailed lizard (*Callisaurus draconoides)*, glossy snake (*Arizona elegans*), coachwhip (*Masticophis flagellum*), gopher snake (*Pituophis melanoleucus*), and the Mojave green rattlesnake (*Crotalus scutulatus*).

Common birds include the turkey vulture (*Cathartes aura*), common raven (*Corvus corax*), sage sparrow (*Amphispiza belli*), barn owl (*Tyto alba*), house finch (*Carpodacus mexicanus*), and western meadowlark (*Sturnella neglecta*). Joshua tree woodlands support cactus wren (*Campylorhynchus brunneicapillus*) and ladder-backed woodpecker (*Picoides scalaris*). Common bird species found in creosote scrub include the horned lark (*Eremophila alpestris*), black-throated sparrow (*Amphispiza bilineata*), and sage sparrow. The seasonal inundation of lakebeds and claypans attracts wading bird species, including the black necked stilt (*Himantopus mexicanus*), American avocet (*Recurvirostra americana*), and greater yellowlegs (*Tringa melanoleuca*). Birds associated with ponds include the yellow-headed blackbird (*Xanthocephalus xanthocephalus*), black-crowned night heron (*Nycticorax nycitorax*), and green heron (*Butorides striatus*).

Horned larks are commonly found in open habitat with sparse vegetation or areas of low shrubs (i.e., open field, agricultural areas, desert habitat, prairies, and grassland communities). The main runways on base are surrounded by arid phase saltbush scrub. Combined with open areas along the flightline, this habitat is suitable for horned larks. The vegetation adjacent to the runways is periodically graded, creating a buffer area devoid of vegetation, which also provides additional foraging habitat for horned larks. Methods that have been used at Edwards AFB to control the bird airstrike problem with horned larks include revegetation with native plants and use of a falconer. The storm water retention pond along the flightline attracts other types of birds (e.g., waterfowl and shorebirds) and possibly bats associated with aquatic habitats. Barn owls (*Tyto alba*) are known to inhabit buildings on the flightline. During the evening, owls feed on small rodents adjacent to the runways and in other areas nearby.

Common mammals on Edwards EFB include the black-tailed jackrabbit (*Lepus californicus*), desert cottontail (*Sylvilagus audobonii*), and coyote (*Canis latrans*). Common rodents include the deer mouse (*Peromyscus maniculatus*), grasshopper mouse (*Onychomys torridus*), little pocket mouse (*Perognathus longimembris*), Merriam’s kangaroo rat (*Dipodymus merriami*), and desert woodrat (*Neotoma lepida*).

Common bats include the western pipistrelle (*Pipistrellus hesperus)*, and little brown bat (*Myotis lucifugus*).

Migratory Birds

Seasonal migratory birds use both permanent and temporary bodies of water for foraging on shrimp and other food items at Edwards AFB. These birds include ducks and geese such as the ruddy duck (*Oxyura jamaicensis*), northern mallard (*Anas platyrhynchos*), northern pintail (*Anas acuta*), Canada goose (*Branta canadensis*), and snow goose (*Chen caerulescens*). Ducks and geese are hunted in designated areas on base.

Designated Critical Habitat

In 1994, the USFWS designated portions of the base as desert tortoise critical habitat (USFWS 1994). Approximately 65,000 acres of the base fall within the Fremont-Kramer Desert Tortoise Critical Habitat Unit.

Desert Tortoise Management Zones

In 1994, the USWFS issued a Biological Opinion for the PIRA that created three Desert Tortoise Management Zones corresponding with mission use in each zone (Edwards AFB 1996). Desert tortoise critical habitat is present within the PIRA desert tortoise management zones; however, the zones extend beyond critical habitat areas. Activities within Zone 1 are not expected to preclude the recovery of the desert tortoise in the Western Mojave Desert. Moderate desert tortoise densities are expected in Zone 2. Zone 3 contains a minimal amount of PIRA support infrastructure and is expected to have minimal improvements and activities. Zone 3 provides the greatest level of protection for desert tortoises because of the high population density of desert tortoises that can be found there.

Significant Ecological Areas

The County of Los Angeles General Plan establishes 61 SEAs, which represent a wide variety of biological communities within the county. The SEAs function to preserve this variety to provide a level of protection to the resources within them. The SEAs are intended to be preserved in an ecologically viable condition for the purposes of education, research, and other non-disruptive outdoor users, but are not intended to preclude limited compatible development.

Los Angeles County has identified two SEAs on Edwards AFB: Edwards AFB (SEA #47) and Rosamond Lake (SEA #50). The locations of these SEAs are shown on Figure C-2. SEA #47 contains botanical

features that are unique and limited in distribution in Los Angeles County. They include the only good stands of mesquite (*Prosopis glandulosa*) in Los Angeles County. The area contains fine examples of creosote bush scrub, alkali sink, and the transition vegetation between the two. Mesquite woodlands provide habitat for a variety of mammals, birds, and reptiles. The best example of shadscale scrub and alkali sink biotic communities in Los Angeles County are in SEA #50. It also contains Piute Ponds, which are located in the southwestern corner of the base. Piute Ponds support a variety of wildlife, especially birds. An important aspect of these ponds is that they provide a stopover area for migratory birds.

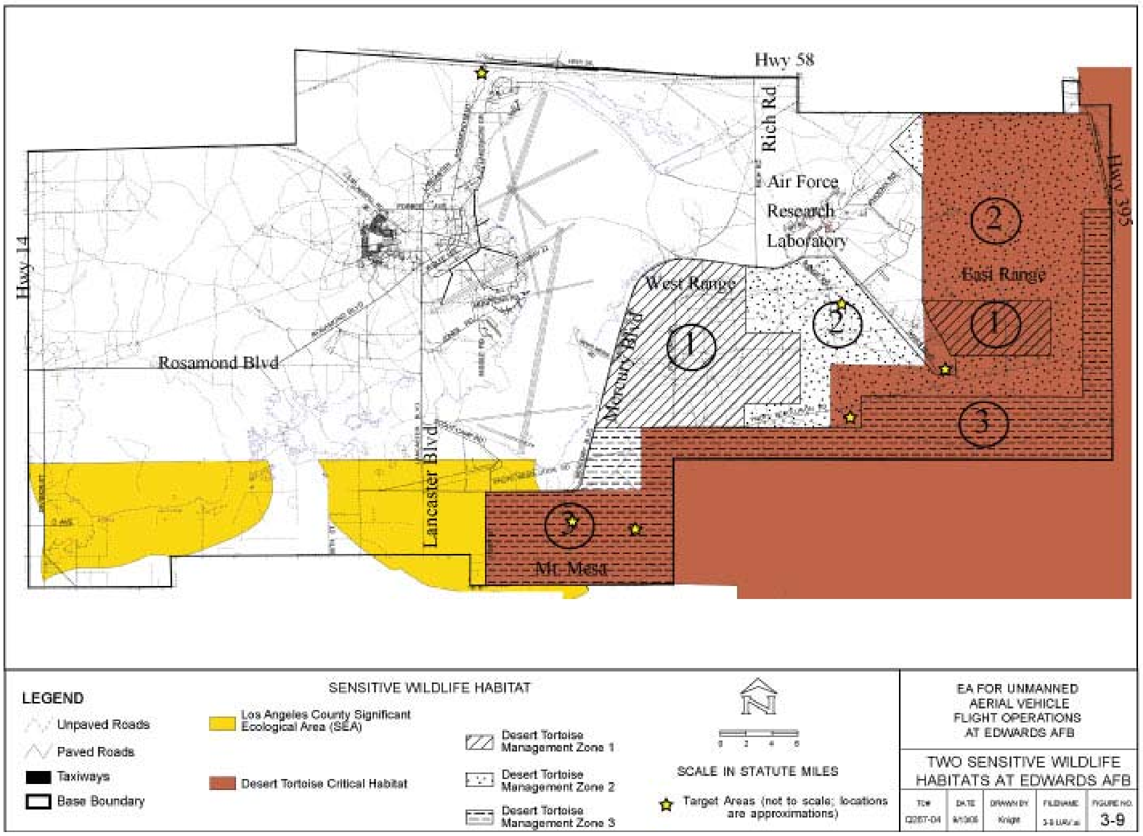


Figure C-2 Sensitive Wildlife Habitats at Edwards AFB

This page intentionally left blank.

D NOISE

This page intentionally left blank.

D.1 NOISE BACKGROUND AND ANALYSIS

The characteristics of sound include parameters such as amplitude, frequency, and duration. The decibel (dB), a logarithmic unit that accounts for the large variations in amplitude, is the accepted standard unit measurement of sound. Different sounds may have different frequency content. When measuring sound to determine its effects on the human population, A-weighted sound levels (dBA) represent adjusted sound levels. The adjustments, created by the American National Standards Institute (1983), are established according to the frequency content of the sound. Examples of typical A-weighted sound levels are shown in Figure D-1.

Noise is usually defined as sound that is undesirable because it interferes with communication and hearing, is intense enough to damage hearing ability, or is otherwise annoying. Noise levels often change with time. Therefore, to compare levels over different time periods, several descriptors were developed to account for the time variances.

These descriptors are used to assess and correlate the various effects of noise on humans, including land use compatibility, sleep and speech interference, annoyance, hearing loss, and startle effects.

- A-weighted decibel scale (dBA). This scale simulates the range of sound that is audible by the human ear. The A-weighted scale significantly reduces the measured pressure level for low frequency sounds while slightly increasing the measured pressure levels for middle frequency sounds. A-weighted sound levels are typically measured between 1,000 to 4,000 hertz (Hz)

- The long-term equivalent A-weighted sound level (Leq). This describes time-varying noise energy as a steady noise level.

- Day-night average noise level (DNL). The DNL, often referred to as L_{dn}, has been adopted by federal agencies as the standard for measuring noise. The DNL is an A-weighted, 24-hour average of hourly averages. Each hourly average represents the sound energy of all the disparate sounds that occurred during that hour. The hourly average would be a continuous, uniform sound whose total sound energy would be equal to the sum of the individual sound energies of all the real sounds occurring during that hour. Typically, different hours of the day would have different hourly averages. For this

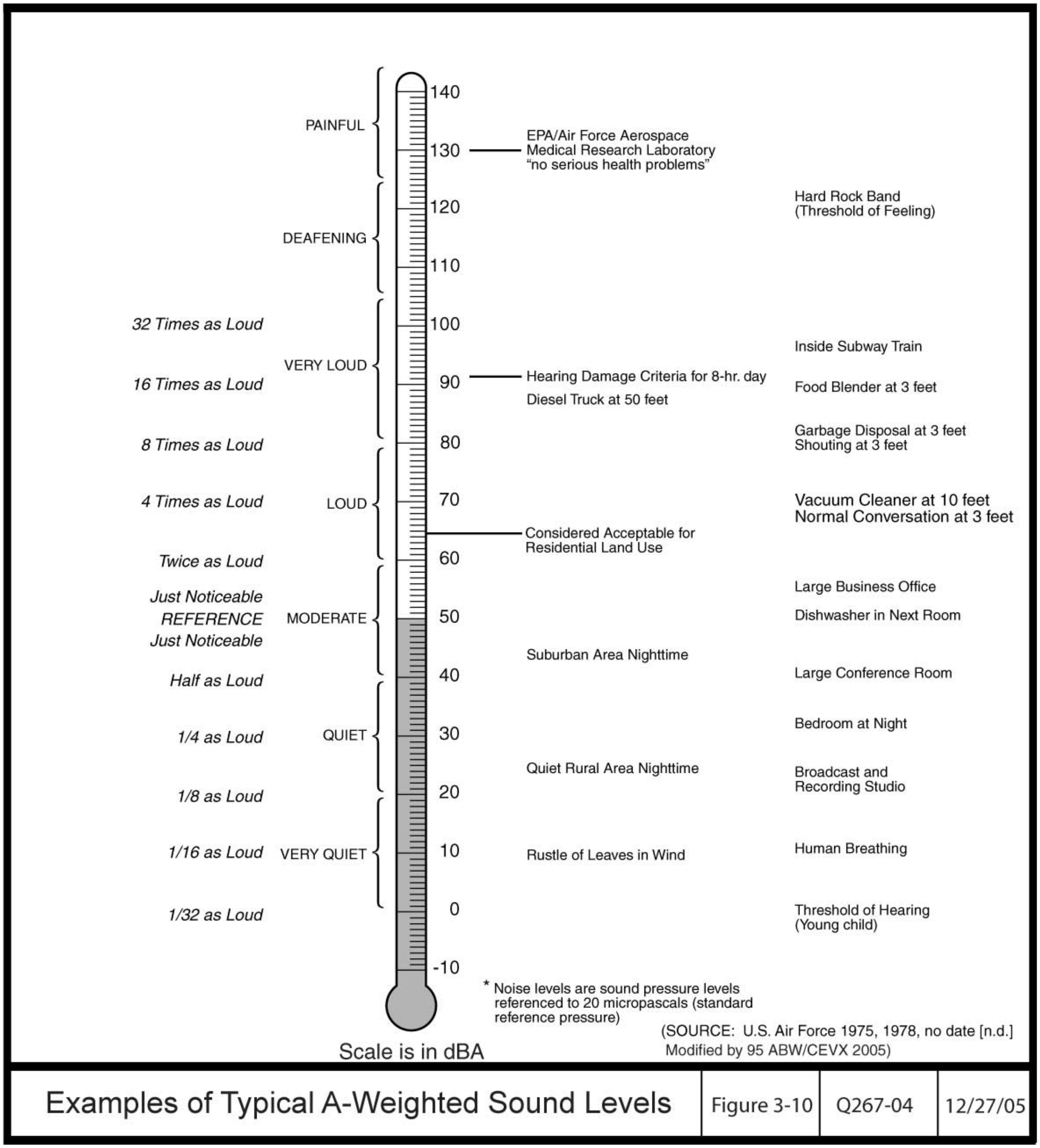


Figure D-1

Examples of Typical A-Weighted Sound Levels

reason, and for standardization, the DNL is defined as the average of the 24 hourly averages of the day.

- C-weighted sound level. C-weighting measures sound levels in dB, with no adjustment to the noise level over most of the audible frequency range except for a slight de-emphasis of the signal below 100 Hz and above 3,000 Hz. C-weighting is used as a descriptor of low-frequency noise sources, such as blast noise, explosive detonations, and sonic booms.

- C-weighted day-night level (CDNL) is the C-weighted sound level averaged over a 24-hour period, with a 10-dB penalty added for noise occurring between 10:00 p.m. and 7:00 a.m. CDNL is similar to DNL, except that C-weighting is used rather than A-weighting. CDNL is used to evaluate human response or annoyance to noise sources, such as blast noise and sonic booms.

- Sound exposure level (SEL) considers both the A-weighted sound level (AL) and duration of noise. SEL converts the total A-weighted sound energy in a given noise event with a given duration into a 1-second equivalent and, therefore, allows direct comparison between sounds with varying intensities and durations.

- C-weighted sound exposure level (CSEL) is an SEL measurement based on the C-weighted level rather than the A-weighted level.

- Sound pressure level (SPL) is a logarithmic scale, using dB as units, and a reference pressure that corresponds approximately to the minimum audible sound pressure.

- Community noise equivalent level (CNEL) has been adopted by the State of California as the descriptor for measuring noise levels. The CNEL is similar to the DNL, except that it includes a 5 dB penalty for evening noise (7:00 p.m. to 10:00 p.m.) in addition to the 10 dB “penalty” for nighttime noise.

In the Levels Document, the U.S. EPA reported that the best metrics to describe the effects of environmental noise in a simple, uniform, and appropriate way were:

- The Leq; and

- The DNL or L_{dn} (a variant of Leq that incorporates a 10-dB "penalty" for nighttime noise).

Another factor that describes how noise is characterized and analyzed is whether the noise source is continuous or impulsive. Continuous noise sources are from highways, construction sites, and cities with heavy traffic and large airports. Impulsive noise generated from munition and ordnance explosions on would be fundamentally different from the continuous noise. For example, permanent damage to unprotected ears due to continuous noise occurs at approximately 85 dB based on an 8-hour-per-day exposure, while the threshold for permanent damage to unprotected ears due to impulsive noise is approximately 140 dB peak noise based on 100 exposures per day (Pater 1976).

Thus given the difference between continuous and impulsive noise, the variations in frequency and period of noise exposure, and the fact that the human ear cannot perceive all pitches and frequencies equally well, a number of different measures of noise levels are used in this assessment: the peak sound level (dBP), the SEL, and the DNL.

1.1.1.1 Measurements of Aircraft Noise Impact on Human Annoyance

In 1977, at the request of the U.S. EPA, the National Academy of Science's Committee on Hearing, Bioacoustics and Biomechanics (CHABA) proposed guidelines for the uniform description and assessment of the various noise environments associated with various projects. In 1982, the U.S. EPA published *Guidelines for Noise Impact Analysis*, based on the CHABA Guidelines. According to CHABA Guidelines, the Leq and DNL were selected as the appropriate descriptors for noise because they reliably correlate with health and welfare effects. From data on community social surveys, DNL has been found to correlate with community annoyance, as measured in terms of percentage of exposed persons who are "highly annoyed" (%HA) (Table D-1).

Correlation between DNL and CDNL has been established based on community reaction to impulsive sounds (CHABA 1981). The DoD has followed the recommendations of CHABA in describing high-intensity impulsive sounds, such as explosions, in terms of C-weighted sound exposure level. Table D-1 shows the relationship between the percent of the population highly annoyed by sound levels expressed as DNL and CDNL.

Table D-1
Relationship Between C-Weighted and A-Weighted Sound Levels and Percent of the Population Annoyed

CDNL (C-weighted)	% Highly Annoyed	DNL (A-weighted)
48	2	50
52	4	55
57	8	60
61	14	65
65	23	70
69	35	75

Note: CDNL can be interpreted in terms of "equivalent annoyance" DNL.

Source: CHABA 1981

A DNL of 65 dBA or lower is considered to be acceptable (Table D-1); a DNL above 65 dBA but not exceeding 75 dBA is normally unacceptable unless some form of noise attenuation is provided; a DNL higher than 75 dBA is unacceptable. Daily exposure to explosions with a CDNL of 61 dB or less is comparable to the DNL 65 dBA significance level for non-impulsive noise.

Explosion noise levels measured as a CSEL also provide a metric for potential impacts to humans over a short-term duration, rather than averaged over a 24-hour period. For example, CSEL values can be used to evaluate potential physiological startle responses and other short-term annoyance factors. Table D-2 shows the relationship among CSEL, peak SPL, and SEL.

Table D-2

Relationship Between SEL, Peak dB, and CSEL

CSEL (dB)	Peak SPL (dB)	SEL (dB)
85.4	113.6	75.9
94.0	121.6	84.5
100.4	127.6	90.9
106.9	133.6	97.4
110.7	137.1	101.2
113.4	139.6	103.9
115.5	141.6	106.0
117.2	143.1	107.7
119.9	145.6	110.4
121.9	147.6	112.4
123.6	149.2	114.1
125.1	150.5	115.6
127.4	152.7	117.9
129.3	154.4	119.8
130.9	155.9	121.4
132.2	157.1	122.7

1.1.1.2 Measurements of Noise Impact on Land Use Compatibility

In 1980, the Federal Interagency Committee on Urban Noise (FICUN) published guidelines for considering noise in land use planning (FICUN 1980). Federal agencies have adopted these guidelines as the standard when making recommendations to local communities on land use compatibility issues. Table D-3 shows the types of land uses that would be appropriate based on a range of DNL values.

Again, a DNL of 65 dBA or lower is considered to be acceptable (Table D-3); a DNL above 65 dBA but not exceeding 75 dBA is normally unacceptable unless some form of noise attenuation is provided; a DNL higher than 75 dBA is unacceptable. Daily exposure to impulsive noise of CDNL of 61 dB or less is comparable to the DNL 65 dBA significance level for non-impulsive noise and is normally considered compatible with most land uses (Table D-1).

Table D-3
Land Use Compatibility

Land Use	Yearly Day-Night Average Sound Level (DNL) in Decibels					
	Below 65	65–70	70–75	75–80	80–85	Over 85
Residential						
Residential, other than mobile homes and transient lodgings	Y	N[1]	N[1]	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N[1]	N[1]	N[1]	N	N
Public Use						
Schools	Y	N[1]	N[1]	N	N	N
Hospitals and nursing homes	Y	25	30	N	N	N
Churches, auditoria, and concert halls	Y	25	30	N	N	N
Government services	Y	Y	25	30	N	N
Transportation	Y	Y	Y[2]	Y[3]	Y[4]	Y[4]
Parking	Y	Y	Y[2]	Y[3]	Y[4]	N
Commercial Use						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale and retail—building materials, hardware, and farm equipment	Y	Y	Y[2]	Y[3]	Y[4]	N
Retail trade—general	Y	Y	25	30	N	N
Utilities	Y	Y	Y[2]	Y[3]	Y[4]	N
Communication	Y	Y	25	30	N	N
Manufacturing and Production						
Manufacturing, general	Y	Y	Y[2]	Y[3]	Y[4]	N
Photographic and optical	Y	Y	25	30	N	N

Table D-3, Page 1 of 3

Table D-3 (Continued)

Land Use Compatibility

Land Use	Yearly Day-Night Average Sound Level (DNL) in Decibels					
	Below 65	65–70	70–75	75–80	80–85	Over 85
Agriculture (except livestock) and forestry	Y	Y[6]	Y[7]	Y[8]	Y[8]	Y[8]
Livestock farming and breeding	Y	Y[6]	Y[7]	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
Recreational						
Outdoor sports arenas and spectator sports	Y	Y[5]	Y[5]	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts, and camps	Y	Y	Y	N	N	N
Golf courses, riding stables, and water recreation	Y	Y	25	30	N	N

Table D-3, Page 2 of 3

Notes: Numbers refer to notes below.

* - The designations contained in this table do not constitute a federal determination that any use of land covered by the program is acceptable or unacceptable under federal, state, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FAA determinations under Part 150 are not intended to substitute federally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise-compatible land uses.

Y (YES) - Land Use and related structures compatible without restrictions.

N (No) - Land Use and related structures are not compatible and should be prohibited.

NLR - Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.

25, 30, or 35 - Land Use and related structures generally compatible; measures to achieve NLR of 25, 30, or 35 dB must be incorporated into design and construction of structures.

Table D-3 (Continued)

Land Use Compatibility

Notes: (Continued)

1 - Where the community determines that residential or school uses must be allowed, measures to achieve outdoor-to-indoor Noise Level Reduction (NLR) of at least 25 dB and 30 dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide an NLR of 20 dB; thus the reduction requirements are often stated as 5, 10, or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year-round. However, the use of NLR criteria will not eliminate outdoor noise problems.

2 - Measures to achieve NLR 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas, or where the normal noise level is low.

3 - Measures to achieve NLR 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.

4 - Measures to achieve NLR 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.

5 - Land-use compatible provided special sound reinforcement systems are installed.

6 - Residential buildings require an NLR of 25.

7 - Residential buildings require an NLR of 30.

8 - Residential buildings not permitted.

Source: 14 CFR Part 150

Figure D-2 shows the cumulative noise levels for restricted area R-2515. The Ldn does not exceed 60 dB.

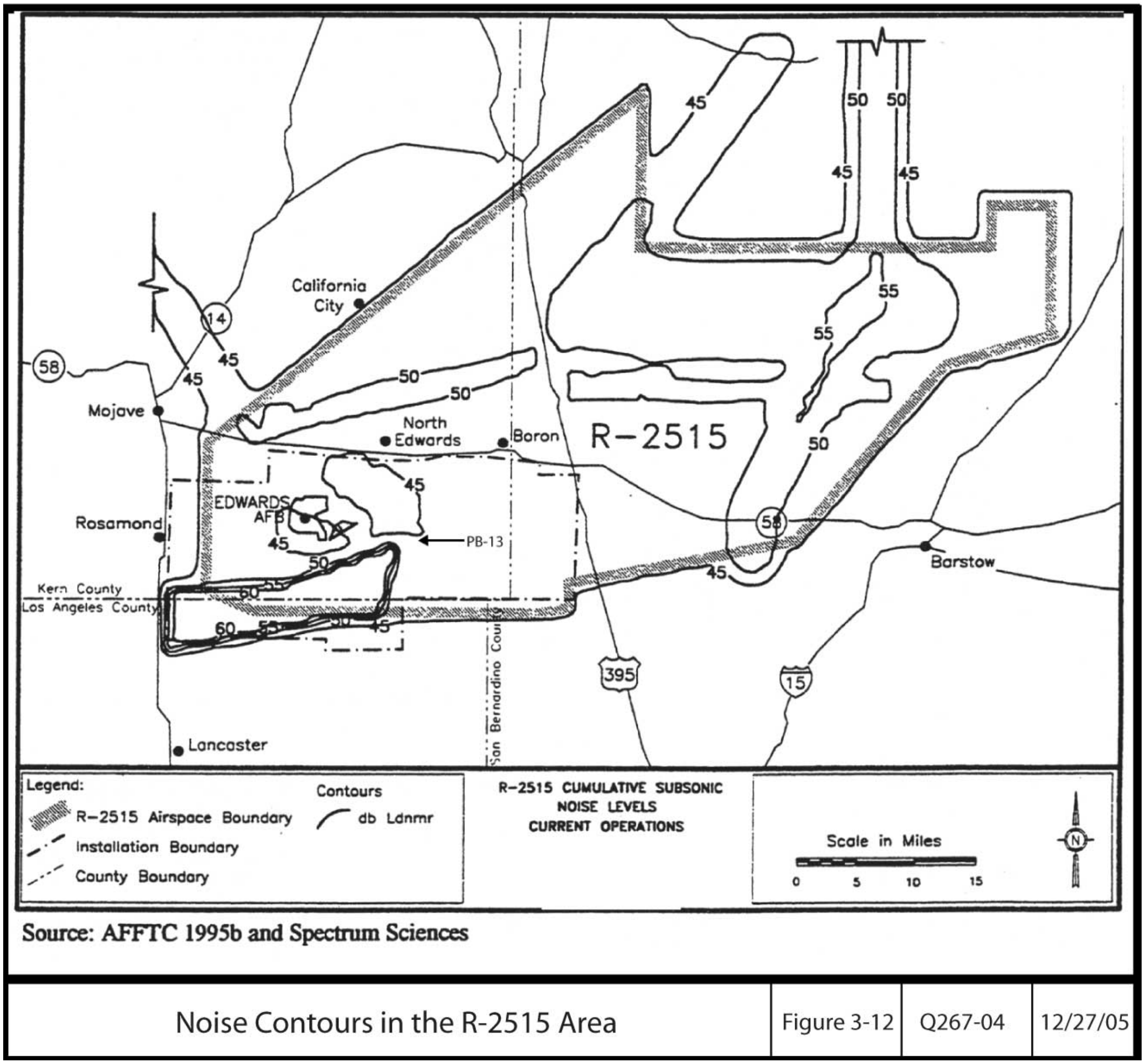


Figure D-2

Cumulative Subsonic Noise Levels for R-2515

E EXAMPLES OF UAVS

This page intentionally left blank.

E.1 EXAMPLES OF UNMANNED AERIAL VEHICLES

Unmanned aerial vehicles have been referred to in many ways: remotely piloted vehicles (RPVs), drones, robot planes, and pilot less aircraft. Most often called UAVs, they are defined by the DoD as powered, aerial vehicles that do not carry a human operator, use aerodynamic forces to provide vehicle lift, can fly autonomously or be piloted remotely, can be expendable or recoverable, and can carry a lethal or non-lethal payload. Ballistic or semi-ballistic vehicles, cruise missiles, and artillery projectiles are not considered UAVs by the DoD definition. Unmanned aerial vehicles range from the size of an insect to that of a commercial airliner. The DoD currently possesses 5 major UAVs: the Air Force's Predator and Global Hawk, the Navy and Marine Corp's Pioneer, and the Army's Hunter and Shadow (Figures E-1 to E-5). Other key UAV developmental efforts include the Joint Unmanned Combat Aerial and System (J-UCAS) (Air Force X45A and Navy X47B) and NASA's Perseus B, Helios, and Proteus. (Figures E-6 to E-10).

Figure E-1 Predator A UAV

Figure E-2 Global Hawk UAV

Figure E-3 Pioneer UAV

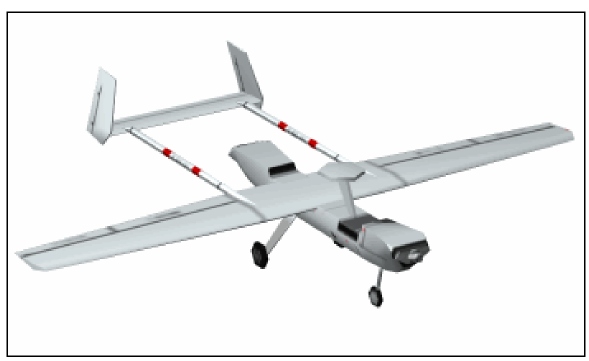


Figure E-4 Hunter UAV

Figure E-5 Shadow UAV

Figure E-6 Air Force X-45A

Figure E-7 Navy X47B

Figure E-8 Perseus B

Figure E-9 Helios

Figure E-10 Proteus

Examples of UAVs that could takeoff and land vertically include the Navy's Fire Scout (Figure E-11) and DARPA's A160 Hummingbird (Figure E-12) and Uninhabited Combat Armed Rotorcraft (UCAR) (Figure E-13).

Figure E-11 Fire Scout

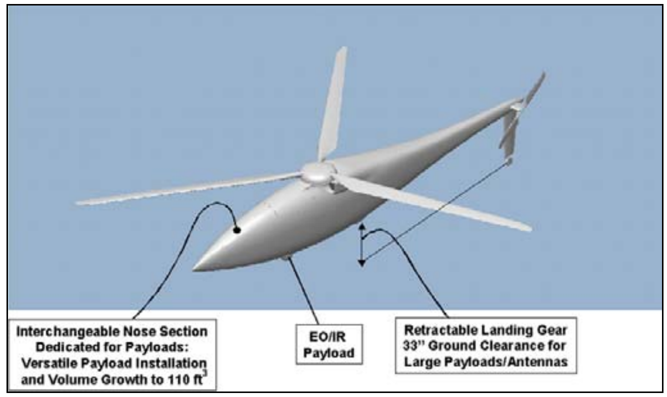


Figure E-12 A160 Hummingbird

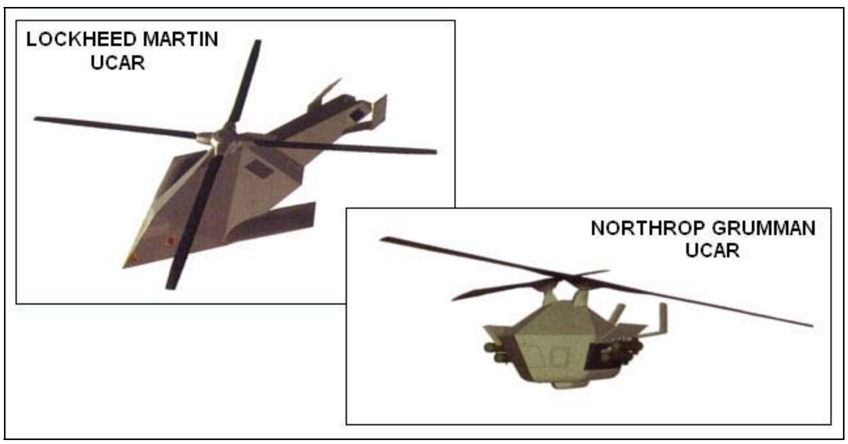


Figure E-13 UCAR

This page intentionally left blank.

F DISTRIBUTION LIST

APPENDIX F—DISTRIBUTION LIST

AFFTC Technical Library
412 TW/TSDL
Edwards AFB, CA 93524

Antelope Valley Air Quality Management District
43301 Division St., Ste. 206
Lancaster, CA 93639-4409
Attn: Charles L. Fryxell APCO
(Or) Bret Banks, Operations Manager

Bureau of Land Management
Barstow Area Office
2601 Barstow Road
Barstow, CA 92311-3221

Bureau of Land Management
Ridgecrest Area Office
300 S. Richmond Road
Ridgecrest, CA 93555-4436

California Department of Fish and Game
1416 Ninth Street
Sacramento, CA 95814

California Department of Parks and Recreation
P.O. Box 942896
Sacramento, CA 94296

City of Lancaster
Planning Department
44933 N. Fern Ave.
Lancaster, CA 93534

Congressman McKeon
Antelope Valley Field Office
1008 W. Avenue M-14 #E-1
Palmdale, CA 93551

Congressman Thomas
4100 Empire Dr.
Bakersfield, CA 93309

Edwards AFB Base Library
95 SPTG/SVMG
5 West Yeager Blvd.
Building 2665
Edwards AFB, CA 93524-1295

Federal Aviation Administration
Western Pacific Region
Attn: Charles Lieber
Airspace Management Branch
15000 Aviation Boulevard
Lawndale, CA 90261

Inyo County Free Library
210 Academy St.
Bishop, CA 93514

Inyo County Free Library
Furnace Creek Branch
PO Box 568
Death Valley, CA 92328

Jerry Schwartz
Environnemental Lead
Surveillance Systems Engineering Group
FAA, AND-402
800 Independence Avenue SW, Room 511
Washington, DC 20591

John O'gara
Head of Environmental Planning
Environmental Office
Code 8G0000D
#1 Administration Circle
Naval Air Weapons Station
China Lake, CA 93555

Kern County APCD
Attn: Thomas Paxson, P.E.
2700 M Street, Suite 302
Bakersfield, CA 93301-2370

Kern County Department of Planning
and Development Services
2700 M Street, Suite 100
Bakersfield, CA 93301-2323

Kern County Library
Boron Branch
26967 20 Mule Team road
Boron, CA 93516

Kern County Library
California City Branch
9507 California City Boulevard
California City, CA 93505

Kern County Library
Mojave Branch
16916-1/2 Highway 14
Mojave, CA 93501

Kern County Library
Ridgecrest Branch
131 East Las Flores Ave
Ridgecrest, CA 93555

Kern County Library
Wanda Kirk Branch (Rosamond)
3611 Rosamond Boulevard
Rosamond, CA 93560

Kern River Valley Library
7054 Lake Isabella Boulevard
Lake Isabella, CA 93240
Attn: Karen Liefield, Branch Supervisor

Los Angeles County Library
Lancaster Branch
601 W. Lancaster Boulevard
Lancaster, CA 93534

Mojave Desert AQMD
14306 Park Ave.
Victorville, CA 92392-2310
Attn: Charles L. Fryxell, APCO

Muhammad Bari
Director of Public Works
HQ NTC Ft. Irwin
Attn: AFZJ-PW-EV
PO Box 105097
Building 285
Fort Irwin, CA 92310-5097

Native American Heritage Commission
915 Capital Mall, Room 364
Sacramento, CA 95814

Office of Historic Preservation
State Historic Preservation Officer
PO Box 942896
Sacramento, CA 94296-0001

Office of Planning and Research
California State Clearinghouse
PO Box 3044
Sacramento, CA 95812-3044

San Bernardino County
Land Use Services Department
Planning Division
385 N. Arrowhead Ave., 1st Floor
San Bernardino, CA 92415-0182

Sierra Club
Antelope Valley Group
P.O. Box 901875
Palmdale, CA 93590

Timbisha Shoshone Tribe
P.O. Box 206
Death Valley, CA 92328-0206
Attn: Pauline Esteves, Chairperson

USDA Forest Service
Pacific Southwest Region
Sequoia National Forest
900 West Grand Avenue
Porterville, CA 93257

U.S. Department of the Interior
National Park Service
Death Valley National Park
PO Box 579
Death Valley, CA 92328

U.S. Department of the Interior
Fish and Wildlife Service
Ventura Field Office
2493 Portola Road, Suite B
Ventura, CA 93003-7726

U.S. Environmental Protection Agency
Region IX
EIS Review Section
75 Hawthorne Street
San Francisco, CA 94105

US Senator Barbara Boxer
501 I Street, Suite 7-600
Sacramento CA 95814

US Senator Diane Feinstein
United States Senate
331 Hart Senate Office Building
Washington, DC 20510

This page intentionally left blank.

G RESPONSE TO COMMENTS

This page intentionally left blank.

Draft Environmental Assessment for Routine and Recurring UAV Flight OPS at Edwards AFB		
Comment #	**Commenter**	**Comment**
Response		
1	Linda White Kern Wind Energy Association Bakersfield, CA	**From:** Linda White **Sent:** Thursday, September 21, 2006 9:45 AM **To:** Deakin Dwight A Civ AFFTC/XPX; Tony Parisi **Subject:** Published EAFB EA on Routine & Recurring Unmanned Aerial Vehicle Flight Operations Dear Dwight and Tony, It has come to my attention that EAFB has published an EA for Routine & Recurring Unmanned Aerial Vehicle Flight Operations in August. I have not had the opportunity to review this document, however, it has the potential to affect the wind industry in Kern County and this concerns me. The EA does affect a significant amount of airspace. Having dealt with the military so closely for the past 5 years, I was extremely dismayed that we were not on the distribution list for notification. Thus, I would like to formerly request that KWEA be placed on your distribution lists. These planning documents are critical to our industry, especially any future development. The mailing address for KWEA is: Kern Wind Energy Association, ATTN: Linda White, POB 41616, Bakersfield, CA 93384. As always, it is our intention to work collaboratively and cooperatively with you. If you have any questions, please do not hesitate to contact me. Sincerely, Linda White **Linda White, Executive Director** ***Kern Wind Energy Association*** *Bakersfield, CA*
Noted. Thank you for your timely response. Potentially there are hundreds of agencies, organizations, and individuals that could have interest in this Environmental Assessment or other NEPA documents developed by the staff at Edwards AFB. To ensure the maximum public distribution		

Draft Environmental Assessment for Routine and Recurring UAV Flight OPS at Edwards AFB		
Comment #	**Commenter**	**Comment**
Response		
and availability within the region of interest (ROI), copies of this Draft Environmental Assessment were provided to libraries, state and county agencies, and citizens groups based on a standardized list. Notices were placed in newspapers with a wide distribution throughout the ROI. Two web sites were developed as an additional means of distribution. Over 2,000 copies of the document were downloaded.		
2	Daina Dahlgren California City, CA	**From:** Veca **Sent:** Thursday, September 07, 2006 5:17 PM **To:** Hatch Gary L Civ AFFTC/PAE **Subject:** Flight Tests I am responding to the notice about the environmental Assessment for "Routine and Recurring" Unmanned Aerial Vehicle Flights. As a 15+ year resident of California City, CA, I am now used to most of the noise from the base. The only question I have is who will pay to fix all the damage to my home from all the "booms" that some of your vehicles make????? We have been in our living room many times when we have been exposed to some of the louder "booms". We sat and watched as cracks formed in the walls. We now have so many that in order to repair said crack, we would have to repaint the whole house inside. Who knows what other damage the noise has done. There are times when the "booms" even shake the beds....with us in them. I respect the fact that these tests have to be done, you just have to understand that as a person on a very fixed income, the added costs are prohibitive at this point. Any information would be greatly appreciated. Sincerely, Daina Dahlgren California City
Thank you for your response. The 95th Air Base Wing Public Affairs Office (95ABW/PA) at Edwards AFB collects information and responds to inquiries concerning possible damage that might have occurred on private property as a result of sonic booms or other military activities initiated from Edwards AFB. Please contact the Public Affairs Office by phone at (661) 277-3510 to discuss your specific concerns or by mail at:		

<table>
<tr><th colspan="3">Draft Environmental Assessment for Routine and Recurring UAV Flight OPS at Edwards AFB</th></tr>
<tr><th>Comment #</th><th>Commenter</th><th>Comment</th></tr>
<tr><th colspan="3">Response</th></tr>
<tr><td colspan="3">Public Affairs
95 ABW/PA
1 S. Rosamond Blvd.
Edwards AFB, CA 93524

or via the Edwards AFB web site at www.edwards.af.mil.</td></tr>
<tr><td>3</td><td>Sophia Anne Merk (SAM)
Saline Preservation Association
Ridgecrest, California</td><td>Thank you for having your solicitor send me a copy of the Draft Environmental Assessment (EA) for Routine and Recurring Unmanned Aerial Vehicle (UAV) Flight Operations at Edwards Air Force Base.</td></tr>
<tr><td colspan="3">Noted. Thank you for your response.</td></tr>
<tr><td>4</td><td>Sophia Anne Merk (SAM)
Saline Preservation Association
Ridgecrest, California</td><td>Representatives of SPA (Saline Valley Association) observed a copy of the NOI (Notice of Intent) hanging up at the BLM Office in Ridgecrest asking for public comment. We contacted you and we were sent a copy of the EA. Obviously we are not on your mailing list. We have some concern that your method of contacting the public is less than acceptable under the spirit of NEPA. SPA has previously commented on your EA's in the past and has asked on three prior occasions to be notified of any actions that would occur in the Saline area or would impact Death Valley National Park.</td></tr>
<tr><td colspan="3">Noted. Thank you for your response. Potentially there are hundreds of agencies, organizations, and individuals that could have interest in this Environmental Assessment or other NEPA documents developed by the staff at Edwards AFB. To ensure the maximum public distribution and availability within the region of interest (ROI), copies of this Draft Environmental Assessment were provided to libraries, federal, state and county agencies, and citizens groups based on a standardized list. Notices were placed in newspapers with a wide distribution throughout the ROI. Two web sites were developed as an additional means of distribution. Over 2,000 copies of the document were downloaded. A copy was sent to Death Valley National Park officials (see distribution list page F-2); as of 1 November 2006 no comments have been were received from park officials.</td></tr>
<tr><td>5</td><td>Sophia Anne Merk (SAM)
Saline Preservation Association
Ridgecrest, California</td><td>SPA has concerns that a document this size, scope and magnitude needs more time to be analyzed by those that will be affected. Even though we did get a verbal extension for two weeks (October 15, 2006) from Gary Hatch, we are asking that the time period for review and comment for this EA be extended until November 1, 2006, so that the general public can provide constructive comments to this document.</td></tr>
</table>

<table>
<tr><th colspan="3">Draft Environmental Assessment for Routine and Recurring UAV Flight OPS at Edwards AFB</th></tr>
<tr><th>Comment #</th><th>Commenter</th><th>Comment</th></tr>
<tr><th colspan="3">Response</th></tr>
<tr><td colspan="3">Noted. Thank you for your response. As noted above, this Environmental Assessment was distributed and made available to the public through various standardized methods. Both CEQ and the California State Clearinghouse recognize a 30-day review period as appropriate. Your request for an additional extension beyond the standard 30-day review period (from September 29, 2006 to October 15, 2006) was approved. As shown on the Web Trends monthly web statistics (attached to the end of this Appendix), over 2,000 downloads of the Draft EA occurred between September 1, 2006 and September 30, 2006; yet no additional requests for an extension from other agencies or the general public have been requested or denied. If any other agency or member of the general public had requested an extension, Edwards AFB would have extended the review period for up to 30 days beyond the published review period. While reviewing your concerns, it was discovered that the public notification that was submitted to the Daily Independent for the August 31, 2006 issue was not published. Consequently, the Public Notice was resent to the Daily Independent extending the review period to November 27, 2006. As of November 28, 2006 no additional comments were received.</td></tr>
<tr><td>6</td><td>Sophia Anne Merk (SAM)
Saline Preservation Association
Ridgecrest, California</td><td>NEPA requires adequate notification to the public. This should be high on your priority list. There are two Public Land Committees that meet in this area. The local BLM Office in Ridgecrest California has a Steering Committee that acts only as an information exchange committee but could have been used by you. They meet once a month. Edwards has never interfaced with this committee. Edwards also did not interface with the California Desert Conservation Area (CDCA) Desert Advisory Council (DAC) Meeting in June sharing this report to them, nor this weekend in Palm Springs to share this document. For your general information, the DAC was authorized under FLPMA (Federal Land Policy Management Act of October 21,1976, 94-579).</td></tr>
<tr><td colspan="3">Noted. Thank you for your response. As noted above, this Environmental Assessment was distributed and made available to the public through various standardized methods. A copy was provided to two BLM offices and the California State Clearinghouse. No comments were received from any of these agencies or and offices that may have jurisdiction for lands under their purview.</td></tr>
<tr><td>7</td><td>Sophia Anne Merk (SAM)
Saline Preservation Association
Ridgecrest, California</td><td>In your notification list, SPA only saw the Timbisha Native Americans being notified. We have previously stated in letters that you need to be contacting other recognized tribes, such as; Owens Valley Paiute-Shoshone, Panamint Shoshone, Southern Paiute, Western Shoshone, Monache, Tubatulabal, Seranno, Kitanemuk, Mohineyam, Kawaiisu, and Chemehuevi which fall under the R-2508. If nothing else, you should contact the Bureau of Indian Affairs for a complete listing of Native Americans residing in R-2508. We expect Edwards Air Force Base to comply with the letter and spirit of the NEPA/CEQA Process. Your mailing list is not inclusive but is selective and did not go to the key stakeholders in the area. There were no Public Scoping Meetings.</td></tr>
<tr><td colspan="3">Noted. Thank you for your response. As noted above, this Environmental Assessment was distributed and made available to the public through various standardized methods. The Draft Environmental Assessment was sent to the Timbisha-Shoshone Tribe in Death Valley and the Native American Heritage Commission. The nine-member Native American Heritage Commission is appointed by the governor. At least five members</td></tr>
</table>

Draft Environmental Assessment for Routine and Recurring UAV Flight OPS at Edwards AFB

Comment #	Commenter	Comment
		Response

of the Commission are elders, traditional people, or spiritual leaders of California Native American tribes. The Native American Heritage Commission reviews environmental impact reports related to property identified to have special religious significance to Native Americans (in California); no comments on the proposed action or alternatives or requests for an extension of the review period were received from either the Native American Heritage Commission or the Timbisha-Shoshone Tribe.

Comment #	Commenter	Comment
8	Sophia Anne Merk (SAM) Saline Preservation Association Ridgecrest, California	Please remember that, although you do have cognizance of your operations on your leased land (R-2515) from the Bureau of Land Management, you still have significant issues that need to be dealt with for the area in R-2508, which is 19,600 square miles. BLM has issued standards for EA's and anything over 100 pages is required by law according to 40 CFR 1500 NEPA regulations to be an EIS. Also, the size (282 pages) of the document indicates that the analysis is extensive and the impacts are substantial. In NEPA terms, this translates into "significance". Significant impacts under NEPA require the preparation of an EIS.

Noted. Thank you for your response. The length of the document is a function of describing the potential alternatives in sufficient detail for the public to understand the scope of the affected environment and environmental consequences. Based on the analysis there were no significant impacts; thus the need for an EIS would not be warranted. The complete Draft Environmental Assessment which is 262 pages vice 282 pages in length includes 187 pages that include the cover sheet, (draft FONSI), summary, table of contents, list of preparers, list of agencies, and organizations to whom a copy of the EA was sent, and appendices; consequently the remainder of the document is not lengthy and is less than half the length of most short EIS's.

According to the Council for *Environmental Quality (CEQ) NEPA 40 Most Frequently Asked Questions*: while the regulations do not contain page limits for EA's, (CEQ) has generally advised agencies to keep the length of EAs to not more than approximately 10-15 pages (# 36a). The DoD is the lead agency for this EA, and as such would set the limit based on its assessment. BLM is a stakeholder, not the lead agency. BLM follows the CEQ NEPA regulations in 40 CFR Part 1500 that recommends that "lead agencies" set page limits, however, no specific reference could be cited that require that NEPA documents over 100 pages to be an EIS. The CEQ NEPA 40 FAQ #36b states that agencies should avoid preparing lengthy EAs except in unusual cases, where a proposal is so complex that a concise document cannot meet the goals of Section 1508.9 and where it is extremely difficult to determine whether the proposal could have significant environmental effects. While it indicates that in most cases, a lengthy EA indicates that an EIS is needed, it does not state that all lengthy EAs should be an EIS. Again, analysis of the data does not support the need for as EIS. Actions that would be conducted under this proposed action are similar to other ongoing actions and would not

Draft Environmental Assessment for Routine and Recurring UAV Flight OPS at Edwards AFB		
Comment #	**Commenter**	**Comment**
Response		
significantly impact any of the resources within the ROI.		
9	Sophia Anne Merk (SAM) Saline Preservation Association Ridgecrest, California	We also believe that this EA clearly indicates that unmanned aircraft will be used at "minimum elevations of 3000 feet", and that "528 flights are projected". This would include flight operations in the Isabella, Owens, Panamint, and Saline work areas that overlie several land management areas including Sequoia-Kings Canyon National Park, John Muir Wilderness, Domeland Wilderness and Death Valley National Park." However, when we add up Table I on page 2, it adds up to a total of 2,713 flights, which is a significant number. The EA should be processed in cooperation with the FAA for safety reasons.
Noted. Thank you for your response. The maximum number of proposed UAV flight test would occur in 2011, when 330 UAV flights and 198 chase aircraft (totaling 528 flights) could takeoff and land at Edwards AFB (page 2 of the Executive Summary). Flights by these UAVs and chase aircraft would still meet the altitude restrictions for flight over the areas you referenced above. The UAVs would be operated under strict safety guidelines to ensure public safety. The number of flights would be less than a 1.5 percent increase in flights in the R-2508 Complex compared to the current number of flights in the same area (page 4-5). This Environmental Assessment was sent to two FAA offices for review; no comments or concerns have been received from the FAA. A detailed description of safety procedures associated with UAV flight operations within the R-2508 Complex and FAA controlled airspace is described in Appendix B.		
10	Sophia Anne Merk (SAM) Saline Preservation Association Ridgecrest, California	Safety should be a major component and to fly unmanned aircraft in Saline (where there is no radar) with Park Service Planes, Private Planes, Inyo County Sheriff and Search and Rescue Planes could be a major problem. Input from FAA as a Cooperating Agency should be in writing as it involves Airspaces R-2508 and R-2515 for all the alternatives except Alternative C.
Noted. Thank you for your response. The UAVs would be operated under strict safety guidelines to ensure public safety. The number of flights would be less than a 1.5 percent increase in flights in the R-2508 Complex compared to the current number of flights in the same area (page 4-5). This Environmental Assessment was sent to two FAA offices for review; no comments or concerns have been received from the FAA. A detailed description of safety procedures associated with UAV flight operations within the R-2508 Complex and FAA controlled airspace is described in Appendix B.		
11	Sophia Anne Merk (SAM) Saline Preservation	We also believe that this Draft EA should not be entitled Draft. Draft indicates that you are still working on it. On pages 1 through 4, a FONSI has been asked for, another indication that it is no

<table>
<tr><th colspan="3">Draft Environmental Assessment for Routine and Recurring UAV Flight OPS at Edwards AFB</th></tr>
<tr><th>Comment #</th><th>Commenter</th><th>Comment</th></tr>
<tr><th colspan="3">Response</th></tr>
<tr><td></td><td>Association
Ridgecrest, California</td><td>longer a draft. In most cases, a FONSI has signatures of all who have read the report and is available to the public. However, on page 4 the verbiage implies that this report may be obtained by contacting Edwards Air Force Base. This document should be included in this EA for public scrutiny and concurrence of the work that should have been completed by Government Employees not Contractors. Under NEPA, Federal Employees are required to prepare Government Publications not Environmental Consulting Firms. We did not find a copy of Air Force Personnel involved in preparation of this document, except for the two authorizing signatures, so could you please provide SPA with this for our files.</td></tr>
<tr><td colspan="3">Noted. Thank you for your response. The Air Force follows specific NEPA guidelines that require public involvement prior to finalizing our decision on the significance of a proposed action and alternatives on the affected environment. As such the “Draft” designation released for public review identifies what the Air Force proposes for this action. The Draft FONSI and Executive Summary summarize what the Air Force has assessed, and unless a significant impact, that cannot be mitigated, is identified by the public during the 30-day review period, the Air Force plans on signing the Draft FONSI. Because this is only a Draft (FONSI and EA), any significant issues identified during the public review period would result in changes to the Draft EA and could potentially result in changes to the Draft FONSI or could a require that the Air Force complete an EIS or withdraw the proposed action. While neither CEQ nor DoD requires that the NEPA document is entirely written by federal employees, federal employees are required to review and approve the decision made. A listing of federal employees involved in the review and approval process will be added to Chapter 7.0.</td></tr>
<tr><td>12</td><td>Sophia Anne Merk (SAM)
Saline Preservation Association
Ridgecrest, California</td><td>In the Draft EA, your conclusion is before your presentation.</td></tr>
<tr><td colspan="3">Noted. Thank you for your response. A summary of the conclusion found in the Executive Summary and at the end of Chapter 2 were provided for the convenience of the reviewer. The detailed conclusion is found in Chapter 4.0.</td></tr>
<tr><td>13</td><td>Sophia Anne Merk (SAM)
Saline Preservation Association
Ridgecrest, California</td><td>Page 3-11 under Wildlife, “Large birds and bird flocks are known to present hazards to aircraft, typically below 5,000 feet AGL in elevation depending upon local terrain.” The 2000 feet of airspace for the “minimum 3000 feet elevation” could be quite detrimental to most flocks and has not been adequately addressed. Also the federally listed western snowy plover also exists at times in Owens Valley, Panamint Valley and Saline Valley. After reading the wildlife list that has been prepared, we find that it has selective overtones and not all were listed from Fish and Game, Sequoia and Death Valley National Parks.</td></tr>
<tr><td colspan="3">Noted. Thank you for your response. We share your concern over the potential impact on birds that may fly between 5,000 and 3,000 feet above</td></tr>
</table>

<table>
<tr><th colspan="3">Draft Environmental Assessment for Routine and Recurring UAV Flight OPS at Edwards AFB</th></tr>
<tr><th>Comment #</th><th>Commenter</th><th>Comment</th></tr>
<tr><th colspan="3">Response</th></tr>
<tr><td colspan="3">ground level (AGL). DoD pilots are trained on bird aircraft strike hazard avoidance procedures to minimize the risk of impact with large birds and bird flocks. Flights by these UAVs and chase aircraft would still meet the altitude restrictions for flight over the areas you referenced above. As noted in the section on Migratory Birds (page 4-18), approximately 12 bird strikes by military aircraft occur each year. During migrating periods and other times when the density of birds along one of the low-level routes are higher than normal a Notice to Airmen may be issued which either warns or restricts flight in those areas. A NOTAM is a real time advisory that is provided to pilots that describes hazards to flight for specific areas and times. Pilots check for NOTAMs before each flight. This Environmental Assessment was provided to U.S. Fish and Wildlife Service, Death Valley National Park officials, and the California Department of Fish and Game; no comments or concerns were received from any of these agencies or their offices.</td></tr>
<tr><td>14</td><td>Sophia Anne Merk (SAM)
Saline Preservation Association
Ridgecrest, California</td><td>Page 4-36 mentions that, “This Programmatic EA only addresses the flight operations of UAVs on DOD test ranges”, so our question is: Is this a Programmatic EA, and if so, it should be an EIS because by your reasoning, it will be used over and over and is significant. Also, if it is only to be used on DOD test ranges, then alternatives A, B, and D should be eliminated.</td></tr>
<tr><td colspan="3">Noted. Thank you for your response. Actually, this EA only addresses flight operations of UAVs on DoD test ranges, restricted areas, warning areas, and the transiting of UAVs between these areas. This EA establishes the number of total flights per year by UAVs and associated chase aircraft from 2006 through 2012 within the R-2508 Complex and identifies specific guidelines for flight that would require a safety review and FAA approval before flight could occur. As authorized by the NEPA process, if an activity has been analyzed, and no significant impacts on the environment would result from those actions, then similar actions would also not be expected to create any significant impacts. Consequently those actions could occur under a categorical exclusion. The actions of “aircraft flight” for these UAVs are similar to manned aircraft which occur routinely and on a recurring basis from Edwards AFB. Because the proposed action and alternatives provide for different operating areas, Alternative A would allow for operations within the R-2508 Complex, Alternative B would allow for operations within the R-2515, and Alternative C would only allow for flight operations above Edwards AFB. Alternatives B and C were analyzed to determine if they were viable would severely limit the ability to test the capabilities of these UAVs; thus should not be eliminated. Alternative D, the no-action alternative which would allow for the status quo. Future proposed projects would be reviewed and evaluated to determine if they fall within the scope of this EA. If so, then these projects may use the analysis presented here and tier off this document. In some cases, a supplement to this EA may be required. If a supplemental EA is required, a new Finding of No Significant Impact (FONSI) would be necessary. Future actions that are found to result in significant impact to the environment that could not be mitigated to a level of insignificance would need to be addressed in an Environmental Impact Statement.</td></tr>
<tr><td>15</td><td>Sophia Anne Merk (SAM)
Saline Preservation Association
Ridgecrest, California</td><td>Under an EIS, Sequoia-Kings Canyon National Park, Death Valley National Park and BLM would have to sign off on whether this is significant or not, including their federal and state threatened and endangered lists and other values in wilderness settings.</td></tr>
</table>

Draft Environmental Assessment for Routine and Recurring UAV Flight OPS at Edwards AFB		
Comment #	**Commenter**	**Comment**
Response		
Thank you for your response. As noted above, this Environmental Assessment was distributed and made available to the public and federal, state, and local agencies through various standardized methods. A copy was provided to two BLM offices, Death Valley National Park, and the California State Clearinghouse. No comments were received from any of these agencies or any offices that may have jurisdiction for lands under their purview.		
16	Sophia Anne Merk (SAM) Saline Preservation Association Ridgecrest, California	Noise levels outside of Edwards Air Force Base in National Park Areas have not been adequately addressed. Flying these types of missions at these low levels do not support wilderness (silence) values for humans and animals.
Thank you for your response. The baseline noise contours for current flight operations occurring within the R-2508 Complex which includes the National Park Areas are addressed in Section 3.5.1. The proposed noise levels outside Edwards AFB as noted in Section 4.5.1 and 4.5.2 show that the noise values would be less than a 0.1–dB increase in DNL and the number of flights would represent approximately a 1.5 percent increase in frequency. In keeping with the agreement with the National Park Service, the UAVs and chase aircraft would remain above 3,000 feet AGL vertically and 3,000 feet laterally around any noise sensitive areas including the Sequoia-Kings Canyon National Park, John Muir Wilderness Area, Domeland Wilderness, and Death Valley National Park.		
17	Sophia Anne Merk (SAM) Saline Preservation Association Ridgecrest, California	There is neither an in-depth cumulative socio-economic report nor cost analysis. A socio-economic report should look at the whole area (R-2508) since the alternatives cover that area, as it will affect such things as private planes, wind turbines and public utilities.
Thank you for your response. The socioeconomic impacts were addressed in Table 2-3 and on page 2-10. Because these flight operations are similar to current operations and no significant changes in the economic infrastructure are expected, no impacts are expected, and therefore any in-depth analysis was not preformed.		
18	Sophia Anne Merk (SAM) Saline Preservation Association Ridgecrest, California	We also believe that the Bureau of Land Management needs to more of an active player in your Environmental Assessments. Most of R-2508 is within the boundaries of the Ridgecrest Field Office and yet when I go to the references, there is no correspondence from the Ridgecrest Regional Office. A case in point is Livestock Grazing from only the Barstow Field Office. Bishop Field Office and Ridgecrest Field Office also has livestock grazing in the affected area but were not included in your analysis.
Thank you for your response. We agree and support involvement by the BLM. The example of Livestock Grazing noted in the cumulative effects section was cited as a specific example of current projects. Since grazing authorizations for the Bishop Field Office would be similar for authorizations for the Barstow and Ridgecrest Offices and the grazing patterns would not be affected, it could be concluded that the cumulative		

<table>
<tr><th colspan="3">Draft Environmental Assessment for Routine and Recurring UAV Flight OPS at Edwards AFB</th></tr>
<tr><th>Comment #</th><th>Commenter</th><th>Comment</th></tr>
<tr><th colspan="3">Response</th></tr>
<tr><td colspan="3">impacts would be similar; no significant impacts. Copies of the Environmental Assessment were sent to the Ridgecrest and Barstow Area Offices of the BLM as well as the State Clearinghouse. No comments were received from BLM or any of the agencies serviced by the State Clearinghouse.</td></tr>
<tr><td>19</td><td>Sophia Anne Merk (SAM)
Saline Preservation Association
Ridgecrest, California</td><td>We would recommend that Edwards follow the lead of Fort Irwin. Their documents contain the following verbiage (from another EIS) and would clearly indicate whose role is what as defined in NEPA.
1.1.1 “ES.1.1 Lead and Cooperating Agencies

A substitution has been made in the lead agency since the 1996 DEIS. The Army, as the project proponent, has assumed the lead agency role from the BLM. The BLM has accepted a cooperating agency role, as they administer a vast majority of the lands within the study area. National Aeronautics and Space Administration (NASA) has also accepted a cooperating agency role. Because some of the alternatives involve possible changes to airspace, the FAA is a cooperating agency. China Lake Naval Air Weapons Station (NAWS China Lake) and Nellis Air Force Base (NAFB) have participated in reviews and meetings but decided not to take formal cooperating agency status.”</td></tr>
<tr><td colspan="3">Thank you for your response. While we did not use the exact wording used by Fort Irwin in their EIS, we feel that each of these agencies and bases had an opportunity to respond and provide comments. No comments were received from BLM or NAWS China Lake. NASA Dryden Flight Research Center did participate in the development of this Environmental Assessment during the development of the description of proposed action and alternatives (DOPAA) and review of the Preliminary Draft Environmental Assessment.</td></tr>
<tr><td>20</td><td>Sophia Anne Merk (SAM)
Saline Preservation Association
Ridgecrest, California</td><td>Lastly, a FONSI is being requested on Page 1 of the document, before any findings are listed. A FONSI is usually issued if there “is no significant findings”. We challenge that it is not significant. In R-2508 (19,600 square miles), there are Private Lands, two National Parks, State Lands, County Lands, Wilderness Areas, Class L, Area of Critical Environmental Concern (ACEC’s), Public Utilities, Wind Farms, Solar Farms and Tribal Lands. Your mailing list is not inclusive but is selective and did not go to the key stakeholders in the area. Over one half of the area in R-2508 falls in Inyo County; however, the Inyo County Planning Department was not sent notification. Again, there were no Public Scoping Meetings, only internal meetings and, so far, no documentation.</td></tr>
<tr><td colspan="3">Thank you for your response. The Draft FONSI was provided on page 1 for information purposes; showing the intent of the Air Force based on the analysis provided in the rest of the document. We agree that a FONSI is usually issued if there are no significant impacts. The areas beneath the R-2508 Complex were established specifically to allow for flight testing in support of National programs; consequently, just because the areas listed above are beneath the lateral limits of the R-2508 does not in itself result in significance. As noted above, this Environmental Assessment was distributed and made available to the public and various federal, state, and local agencies through various standardized methods. While</td></tr>
</table>

<table>
<tr><th colspan="3">Draft Environmental Assessment for Routine and Recurring UAV Flight OPS at Edwards AFB</th></tr>
<tr><th>Comment #</th><th>Commenter</th><th>Comment</th></tr>
<tr><th colspan="3">Response</th></tr>
<tr><td colspan="3">“Scoping Meetings” are required for an EIS, they are not required for an EA.</td></tr>
<tr><td>21</td><td>Sophia Anne Merk (SAM)
Saline Preservation Association
Ridgecrest, California</td><td>Alternative D is listed as a No Action Alternative; however, a No Action means exactly that. The Alternative D listed under Page 2-8 “is the status quo” which never received formal inclusion in other EA’s or EIS’s to date. If the status quo (many programs were listed under Alternative D) was documented, please provide me with the Record of Decision’s on those programs.</td></tr>
<tr><td colspan="3">Thank you for your response. NEPA the “Law” and the CEQ Regulations require but do not define the “no action” alternative. There are, however, two distinct interpretations of "no action”. In the “Forty Most Asked Questions”, CEQ says that the no action alterative “provides a benchmark, enabling decisionmakers to compare the magnitude of environmental effects of the action alternatives.” CEQ notes that for newly proposed actions, “no action” means “the proposed activity would not take place, and the resulting environmental effects from taking no action would be compared with the effects of permitting the proposed activity or an alterative activity to go forward.” CEQ also notes that for continuing actions (“ongoing programs, management plans, etc), no action means “continuing with the present course of action until that action is changed.” The “no action” alternative is sometimes referred to as the “Status Quo” alterative. While CEQ emphases the importance of the “no action” alternative the courts have not addressed these definitions and have allowed very brief discussions of this alternative. The decision record for operations noted in Alternative D for the Global Hawk, Predator, and other UAVs can be found on the World Wide Web.</td></tr>
<tr><td>22</td><td>Sophia Anne Merk (SAM)
Saline Preservation Association
Ridgecrest, California</td><td>SPA finds that we can endorse no alternatives without your addressing our concerns.</td></tr>
<tr><td colspan="3">Thank you for your response. The responses noted for comments #3 through #21 have been developed based on a careful review of your comments. We believe the impacts on the human and natural environment are less than significant, and feel a FONSI is warranted.</td></tr>
<tr><td>23</td><td>NPLNEWS</td><td>From: NPLNEWS [mailto:publiclands@nplnews.com]
Sent: Thursday, September 14, 2006 12:37 PM
To: Hatch Gary L Civ AFFTC/PAE
Cc: craigp@co.kern.ca.us
Subject: UAV-EA
Sensitivity: Confidential

This letter is regarding the Notice of Availability Draft Environmental Assessment for Routine and Recurring Unmanned Aerial Vehicle (UAV) Flight Operations at Edwards Air Force Base.</td></tr>
</table>

<table>
<tr><th colspan="3">Draft Environmental Assessment for Routine and Recurring UAV Flight OPS at Edwards AFB</th></tr>
<tr><th>Comment #</th><th>Commenter</th><th>Comment</th></tr>
<tr><th colspan="3">Response</th></tr>
<tr><td></td><td></td><td>The size of the document indicates that the analysis is extensive and the impacts are substantial. In NEPA terms, this translates into "significance". Significant impacts under NEPA require the preparation of an EIS, according to 40 CFR 1500 NEPA regulations. We understand that the Air Force has its own NEPA program and policies, but we do not believe that they deviate that much from the concept of disclosing to the public major effects of federal actions conducted on their behalf.

Please provide a copy of the current "draft" NEPA document that is out for public review to the address below.

Also, please reconsider the decision to complete an EA and start the scoping for the EIS process as soon as possible.

Thanks for your consideration. We look forward to working with you in the future.

NPLNEWS
P.O. Box 527
Ridgecrest, CA 93556
cc: Craig Peterson, Kern County</td></tr>
<tr><td colspan="3">Thank you for your response. The response noted under comment # 8 addresses your concern regarding length of the document and “significance”. Due to the routine and recurring nature of activities proposed by this EA we believe impacts on the human and natural environment are less than significant, and feel a FONSI is warranted.</td></tr>
<tr><td>24</td><td>Office of Planning and Research
Sacramento, CA</td><td>The State Clearinghouse submitted the above named Environmental Assessment (Routine and Recurring Unmanned Aerial Vehicle Flight Operations at Edwards AFB SCH# 2006084002) to selected state agencies for review. The review period closed on September 29, 2006, and no state agencies submitted comments by that date. This letter acknowledges that you have complied with the State Clearinghouse review requirements for draft environmental documents, pursuant to the California Environmental Quality Act.</td></tr>
<tr><td colspan="3">Noted. Thank you for your response.</td></tr>
</table>

From: Deakin Dwight A Civ AFFTC/XPX
Sent: Thursday, September 21, 2006 11:19 AM
To: Linda White; Tony Parisi
Cc: Dyas Keith Civ 95 ABW/CEV; Hatch Gary L Civ AFFTC/PAE
Subject: RE: Published EAFB EA on Routine & Recurring Unmanned Aerial Vehicle Flight Operations

Linda,
I would recommend you review the document before you get too upset. It is quite mundane & I'm fairly certain there are no impacts to KWEA as it simply documents our continued use of one type of vehicle we operate. We do lots of environmental documentation to cover all aspects of our operations. From Hypersonics & Directed Energy to everyday flying. Tony & I are always on the lookout for any potential implications to our partners & would send up a flair if we saw something of significance. As I mentioned to Ed the other day - we take our relationship with KWEA very seriously & would not deliberately do anything to jeopardize that.

That being said....we will certainly add you to the distribution/notification lists for your reading pleasure.

Keith/Gary,
Please let me know if there is any issue adding KWEA to the distribution/notification lists?

Respectfully,

Dwight

Dwight A. Deakin, NH-IV
Chair, Encroachment Prevention & Management Committee
R-2508 Complex Sustainability Officer
Range Commanders' Council Sustainability Group Vice Chair
AFFTC/XPX
661 277-2412
Fax 277-8469
DSN 527

From: Linda White [mailto:kweawhite@sbcglobal.net]
Sent: Thursday, September 21, 2006 9:45 AM
To: Deakin Dwight A Civ AFFTC/XPX; Tony Parisi
Subject: Published EAFB EA on Routine & Recurring Unmanned Aerial Vehicle Flight Operations

Dear Dwight and Tony,

It has come to my attention that EAFB has published an EA for
Routine & Recurring Unmanned Aerial Vehicle Flight Operations in August. I have not had the opportunity to review this document, however, it has the potential to affect the wind industry in Kern County and this concerns me. The EA does affect a significant amount of airspace.

Having dealt with the military so closely for the past 5 years, I was extremely dismayed that we were not on the distribution list for notification. Thus, I would like to formerly request that KWEA be placed on your distribution lists. These planning documents are critical to our industry,

especially any future development. The mailing address for KWEA is: Kern Wind Energy Association, , Bakersfield, CA 93384.

As always, it is our intention to work collaboratively and cooperatively with you. If you have any questions, please do not hesitate to contact me.

Sincerely,

Linda White

Linda White, Executive Director
Kern Wind Energy Association

Bakersfield, CA 93384

From: Veca [mailto:vecadaina@verizon.net]
Sent: Thursday, September 07, 2006 5:17 PM
To: Hatch Gary L Civ AFFTC/PAE
Subject: Flight Tests

I am responding to the notice about the environmental Assessment for "Routine and Recurring" Unmanned Aerial Vehicle Flights.
As a 15+ year resident of California City, CA, I am now used to most of the noise from the base.
The only question I have is who will pay to fix all the damage to my home from all the "booms" that some of your vehicles make?????
We have been in our living room many times when we have been exposed to some of the louder "booms". We sat and watched as crackes formed in the walls.
We now have so many that in order to repair said crack, we would have to repaint the whole house inside.
Who knows what other damage the noise has done. There are times when the "booms" even shake the beds....with us in them.
I respect the fact that thses tests have to be done, you just have to understand that as a person on a very fixed income, the added costs are prohibitive at this point.
Any information would be greatly appreciated.
Sincerely,
Daina Dahlgren
California City

October 15, 2006

95th Air Base Wing Civil Engineer Directorate
Environmental Management Division
Attn: Gary Hatch
5 E. Popson Ave.
Edwards AFB, CA 93524-8060

Subject: Draft Environmental Assessment for Routine and Recurring Unmanned Aerial Vehicle (UAV) Flight Operations at Edwards Air Force Base

Dear Gary,

Thank you for having your solicitor send me a copy of the Draft Environmental Assessment (EA) for Routine and Recurring Unmanned Aerial Vehicle (UAV) Flight Operations at Edwards Air Force Base.

Representatives of SPA (Saline Valley Association) observed a copy of the NOI (Notice of Intent) hanging up at the BLM Office in Ridgecrest asking for public comment. We contacted you and we were sent a copy of the EA. Obviously we are not on your mailing list. We have some concern that your methods of contacting the public is less than acceptable under the spirit of NEPA. SPA has previously commented on your EA's in the past and has asked on three prior occasions to be notified of any actions that would occur in the Saline area or would impact Death Valley National Park.

SPA has concerns that a document this size, scope and magnitude needs more time to be analyzed by those that will be affected. Even though we did get a verbal extension for two weeks (October 15, 2006) from Gary Hatch, we are asking that the time period for review and comment for this EA be extended until November 1, 2006, so that the general public can provide constructive comments to this document.

NEPA requires adequate notification to the public. This should be high on your priority list. There are two Public Land Committees that meet in this area. The local BLM Office in Ridgecrest California has a Steering Committee that acts only as an information exchange committee but could have been used by you. They meet once a month. Edwards has never interfaced with this committee. Edwards also did not interface with the California Desert Conservation Area (CDCA) Desert Advisory Council (DAC) Meeting in June sharing this report to them, nor this weekend in Palm Springs to share this document. For your general information, the DAC was authorized under FLPMA (Federal Land Policy Management Act of October 21,1976, 94-579).

In your notification list, SPA only saw the Timbisha Native Americans being notified. We have previously stated in letters that you need to be contacting other recognized tribes, such as; Owens Valley Paiute-Shoshone, Panamint Shoshone, Southern Paiute, Western Shoshone, Monache, Tubatulabal, Seranno, Kitanemuk, Mohineyam, Kawaiisu, and

Chemehuevi which fall under the R-2508. If nothing else, you should contact the Bureau of Indian Affairs for a complete listing of Native Americans residing in R-2508. We expect Edwards Air Force Base to comply with the letter and spirit of the NEPA/CEQA Process. Your mailing list is not inclusive but is selective and did not go to the key stakeholders in the area. There were no Public Scoping Meetings.

Please remember that, although you do have cognizance of your operations on your leased land (R-2515) from the Bureau of Land Management, you still have significant issues that need to be dealt with for the area in R-2508, which is 19,600 square miles. BLM has issued standards for EA's and anything over 100 pages is required by law according to 40 CFR 1500 NEPA regulations to be an EIS. Also, the size (282 pages) of the document indicates that the analysis is extensive and the impacts are substantial. In NEPA terms, this translates into "significance". Significant impacts under NEPA require the preparation of an EIS.

We also believe that this EA clearly indicates that unmanned aircraft will be used at “minimum elevations of 3000 feet”, and that “528 flights are projected”. This would include flight operations in the Isabella, Owens, Panamint, and Saline work areas that overlie several land management areas including Sequoia-Kings Canyon National Park, John Muir Wilderness, Domeland Wilderness and Death Valley National Park.” However, when we add up Table I on page 2, it adds up to a total of 2,713 flights, which is a significant number. The EA should be processed in cooperation with the FAA for safety reasons.

Safety should be a major component and to fly unmanned aircraft in Saline (where there is no radar) with Park Service Planes, Private Planes, Inyo County Sheriff and Search and Rescue Planes could be a major problem. Input from FAA as a Cooperating Agency should be in writing as it involves Airspaces R-2508 and R-2515 for all the alternatives except Alternative C.

We also believe that this Draft EA should not be entitled Draft. Draft indicates that you are still working on it. On pages 1 through 4, a FONSI has been asked for, another indication that it is no longer a draft. In most cases, a FONSI has signatures of all who have read the report and is available to the public. However, on page 4 the verbiage implies that this report may be obtained by contacting Edwards Air Force Base. This document should be included in this EA for public scrutiny and concurrence of the work that should have been completed by Government Employees not Contractors. Under NEPA, Federal Employees are required to prepare Government Publications not Environmental Consulting Firms. We did not find a copy of Air Force Personnel involved in preparation of this document, except for the two authorizing signatures, so could you please provide SPA with this for our files.

In the Draft EA, your conclusion is before your presentation.

Page 3-11 under Wildlife, “Large birds and bird flocks are known to present hazards to aircraft, typically below 5,000 feet AGL in elevation depending upon local terrain.” The 2000 feet of airspace for

the “minimum 3000 feet elevation” could be quite detrimental to most flocks and has not been adequately addressed. Also the federally listed western snowy plover also exists at times in Owens Valley, Panamint Valley and Saline Valley. After reading the wildlife list that has been prepared, we find that it has selective overtones and not all were listed from Fish and Game, Sequoia and Death Valley National Parks.

Page 4-36 mentions that, “This Programmatic EA only addresses the flight operations of UAVs on DOD test ranges”, so our question is: Is this a Programmatic EA, and if so, it should be an EIS because by your reasoning, it will be used over and over and is significant. Also, if it is only to be used on DOD test ranges, then alternatives A, B, and D should be eliminated.

Under an EIS, Sequoia-Kings Canyon National Park, Death Valley National Park and BLM would have to sign off on whether this is significant or not, including their federal and state threatened and endangered lists and other values in wilderness settings.

Noise levels outside of Edwards Air Force Base in National Park Areas have not been adequately addressed. Flying these types of missions at these low levels do not support wilderness (silence) values for humans and animals.

There is neither an in-depth cumulative socio-economic report nor cost analysis. A socio-economic report should look at the whole area (R-2508) since the alternatives cover that area, as it will affect such things as private planes, wind turbines and public utilities.

We also believe that the Bureau of Land Management needs to more of an active player in your Environmental Assessments. Most of R-2508 is within the boundaries of the Ridgecrest Field Office and yet when I go to the references, there is no correspondence from the Ridgecrest Regional Office. A case in point is Livestock Grazing from only the Barstow Field Office. Bishop Field Office and Ridgecrest Field Office also has livestock grazing in the affected area but were not included in your analysis.

We would recommend that Edwards follow the lead of Fort Irwin. Their documents contain the following verbiage (from another EIS) and would clearly indicate whose role is what as defined in NEPA.

“ES.1.1 Lead and Cooperating Agencies

A substitution has been made in the lead agency since the 1996 DEIS. The Army, as the project proponent, has assumed the lead agency role from the BLM. The BLM has accepted a cooperating agency role, as they administer a vast majority of the lands within the study area. National Aeronautics and Space Administration (NASA) has also accepted a cooperating agency role. Because some of the alternatives involve possible changes to airspace, the FAA is a cooperating agency. China Lake Naval Air Weapons Station (NAWS China Lake) and Nellis Air Force Base (NAFB) have participated in reviews and meetings but decided not to take formal cooperating agency status.”

Lastly, a FONSI is being requested on Page 1 of the document, before any findings are listed. A FONSI is usually issued if there "is no significant findings". We challenge that it is not significant. In R-2508 (19,600 square miles), there are Private Lands, two National Parks, State Lands, County Lands, Wilderness Areas, Class L, Area of Critical Environmental Concern (ACEC's), Public Utilities, Wind Farms, Solar Farms and Tribal Lands. Your mailing list is not inclusive but is selective and did not go to the key stakeholders in the area. Over one half of the area in R-2508 falls in Inyo County; however, the Inyo County Planning Department was not sent notification. Again, there were no Public Scoping Meetings, only internal meetings and, so far, no documentation.

Alternative D is listed as a No Action Alternative; however, a No Action means exactly that. The Alternative D listed under Page 2-8 "is the status quo" which never received formal inclusion in other EA's or EIS's to date. If the status quo (many programs were listed under Alternative D) was documented, please provide me with the Record of Decision's on those programs.

SPA finds that we can endorse no alternatives without your addressing our concerns.

If you would like to discuss this with me during the day, you may reach me at during the day or leave a message at . Thank you for your consideration in this matter.

Sophia Anne Merk (SAM)
Saline Preservation Association

Ridgecrest, California 93555

Cc:
Council of Environmental Quality
Senator Feinstein
Senator Boxer
Congressman McKeon
Supervisor McQuiston
Desert Advisory Committee
Inyo County Planning Department
Kern County Planning Department
NPL News
Private Pilot Association
Wind Energy Association
Bureau of Indian Affairs
Death Valley National Park
Sequoia-Kings Canyon National Park
BLM-State Director, Ridgecrest Field Office, California District Office, Bishop and Ridgecrest Field Offices

-----Original Message-----
From: NPLNEWS [mailto:publiclands@nplnews.com]
Sent: Thursday, September 14, 2006 12:37 PM
To: Hatch Gary L Civ AFFTC/PAE
Cc: craigp@co.kern.ca.us
Subject: UAV-EA
Sensitivity: Confidential

This letter is regarding the Notice of Availability Draft Environmental Assessment for Routine and Recurring Unmanned Aerial Vehicle (UAV) Flight Operations at Edwards Air Force Base.

The size of the document indicates that the analysis is extensive and the impacts are substantial. In NEPA terms, this translates into "significance". Significant impacts under NEPA require the preparation of an EIS, according to 40 CFR 1500 NEPA regulations. We understand that the Air Force has its own NEPA program and policies, but we do not believe that they deviate that much from the concept of disclosing to the public major effects of federal actions conducted on their behalf.

Please provide a copy of the current "draft" NEPA document that is out for public review to the address below.

Also, please reconsider the decision to complete an EA and start the scoping for the EIS process as soon as possible.

Thanks for your consideration. We look forward to working with you in the future.

NPLNEWS
P.O. Box 527
Ridgecrest, CA 93556

cc: Craig Peterson, Kern County

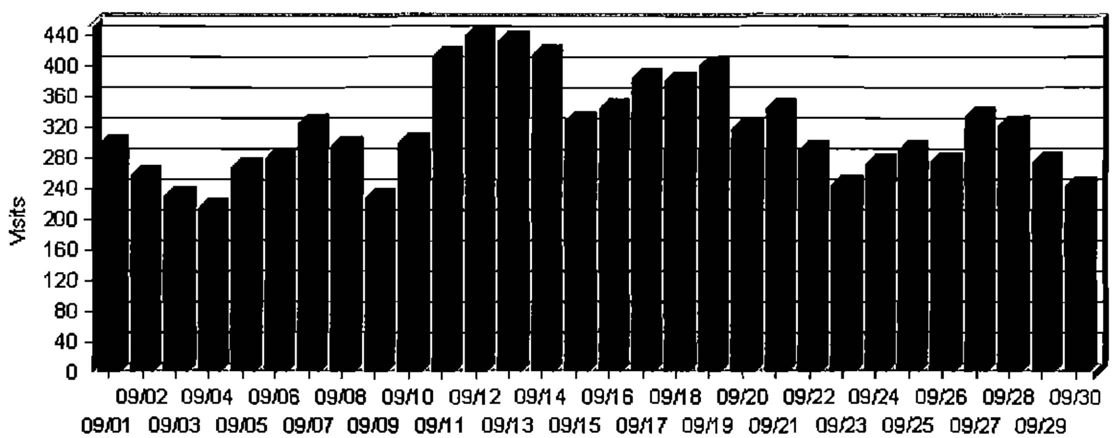
AFFTC - Penvmng Monthly Web Statistics
AFFTC - Penvmng

09/01/2006 00:00:00 - 09/30/2006 23:59:59 Monday October 02, 2006 - 13:59:13

General Statistics Help

The Visits graph displays the overall number of visits to your Web site. The General Statistics table provides an overview of the activity for your Web site during the specified time frame.

Visits



Fri 09/01/2006 - Sat 09/30/2006 (1 Month Scale)

General Statistics

Hits	Entire Site (Successful)	49,590
	Average Per Oay	1,653
	Home Page	N/A
Page Views	Page Views (Impressions)	27,186
	Average Per Day	906
	Oocument Views	27,128
Visits	Visits	9,469
	Average Per Day	315
	Average Visit Length	00:35:48
	Median Visit Length	00:11:58
	International Visits	0%
	Visits of Unknown Origin	100%
	Visits from United States	0%
Visitors	Unique Visitors	4,533
	Visitors Who Visited Once	3,373
	Visitors Who Visited More Than Once	1,160

General Statistics - Help Card

Average Hits Per Day - Number of successful hits divided by the total number of days in the log.

Average Page Views Per Day - Number of page views divided by the total number of days in the log.

Average Visits Per Day - Number of visits divided by the total number of days in the log.

Average Visit Length - Average of non-zero length visits in the log.

Hit - A single action on the Web server as it appears in the log file. A visitor downloading a single file is logged as a single hit, while a visitor requesting a Web page including two images registers as three hits on the server; one hit is the request for the .html page, and two additional hits are requests for the downloaded image files. While the volume of hits is an indicator of Web server traffic, it is not an accurate reflection of how many pages are being looked at.

Most Downloaded Files

	File	No. of Downloads	% of Total Downloads	Visits
1	http://www.edwards.af.mil/ penvmng/Documents/UAVEA/ DraftUAVEA.pdf	2,087	40.78%	91
2	http://www.edwards.af.mil/ penvmng/aboutedwards/Conservation/ ICRMP+Update+2005.pdf	132	2.57%	70
3	http://www.edwards.af.mil/ penvmng/Documents/Investment/ invest.pdf	241	4.7%	69
4	http://www.edwards.af.mil/ penvmng/aboutedwards/Conservation/ Documents/AFFTCI32-8.pdf	87	1.7%	66
5	http://www.edwards.af.mil/ penvmng/Documents/ConsStatus/ consstatrpt31mar03.pdf	65	1.27%	58
6	http://www.edwards.af.mil/ penvmng/Documents/UAVEA/ SUMMARYUAVDEA.pdf	71	1.38%	56
7	http://www.edwards.af.mil/ penvmng/aboutedwards/Conservation/ Documents/huntingmaps.pdf	88	1.71%	51
8	http://www.edwards.af.mil/ penvmng/Documents/OU2+PP/ Final_Proposed_Plan.pdf	146	2.85%	50
9	http://www.edwards.af.mil/ penvmng/Documents/factsheets/ Conserv/salnradar.pdf	57	1.11%	49
10	http://www.edwards.af.mil/ penvmng/aboutedwards/Conservation/ FINAL+ICRMP+w-signature.pdf	70	1.36%	49
11	http://www.edwards.af.mil/ penvmng/aboutedwards/Conservation/ Documents/mainmap.pdf	55	1.07%	48
12	http://www.edwards.af.mil/ penvmng/aboutedwards/Conservation/ eainrmp.pdf	194	3.79%	47
13	http://www.edwards.af.mil/ penvmng/Documents/factsheets/ERP/ site13fs.pdf	63	1.23%	47
14	http://www.edwards.af.mil/ penvmng/Documents/factsheets/ERP/ site443.pdf	60	1.17%	46
15	http://www.edwards.af.mil/ penvmng/aboutedwards/Conservation/ Final+SV+Radar+EA.pdf	53	1.03%	45
16	http://www.edwards.af.mil/ penvmng/Documents/factsheets/ Conserv/offroadspecies.pdf	45	0.87%	43
17	http://www.edwards.af.mil/ penvmng/Documents/UAVEA/TOC.pdf	52	1.01%	42
18	http://www.edwards.af.mil/ penvmng/aboutedwards/Conservation/ Documents/Waterfowl+Annual+ Report.pdf	44	0.85%	41
19	http://www.edwards.af.mil/ penvmng/Documents/h20quality/ 2005CCRAFRL.pdf	44	0.85%	41
20	http://www.edwards.af.mil/ penvmng/aboutedwards/Conservation/ Documents/branchparkmap.pdf	45	0.87%	40
Total For the Files Above		**3,699**	**72.28%**	**N/A**

Most Downloaded Files - Help Card

Downloads - Number of times the specified file was downloaded by a visitor. If an error occurred during the transfer, that transfer is not counted.

Files - The path and filename of the downloaded file.

Visits - Number of visits which resulted in at least one download of the specified file. If a visitor downloads the file more than once per visit, it does not count as another visit. If a visitor is idle longer than the idle-time limit, WebTrends assumes the visit was voluntarily terminated. If the visitor continues to browse your site after they reach the idle-time limit, a new visit is counted. The default idle-time limit is thirty minutes.

% - Percentage of times the specified file was downloaded out of all downloaded files.

This information shows you the most popular downloadable files on your Web site. Files that don't appear on the list, or appear low on the list, may require maintenance such as decreasing the file size, improving link placement, or elimination to make room for more popular content.

Hits: Entire Site (Successful) - Number of hits that had a "success" status code.

International Visits - Percentage of visitors defined as "international" in Domain Options.

Home Page Hits - Number of times your home page was visited.

Median Visit Length - Median of non-zero length visits in the log. Half the visit lengths are longer than the median, and half are shorter. This number is often closer to the "typical" visit length than the average visit length. Numbers that are wildly atypical can skew the average, but will not skew the median so much.

Page - Any document, dynamic page, or form. Documents are user-defined in Options, but typically include all static content, such as complete html pages. Dynamic pages are created with variables and do not exist anywhere in a static form. Forms are scripted pages which get information from a visitor and pass it back to the server.

Page Views - Hits to files designated as pages. Supporting graphics and other non-page files are not counted.

Page Views: Document Views - Hits to pages that are defined as documents. This entry excludes hits to dynamic pages and forms.

Unique Visitors- Individuals who visited your site during the report period. If someone visits more than once, they are counted only the first time they visit.

Visits - Number of times a visitor came to your site. If a visitor is idle longer than the idle-time limit, WebTrends assumes the visit was voluntarily terminated. If the visitor continues to browse your site after they reach the idle-time limit, a new visit is counted. The default idle-time limit is thirty minutes.

Visits from the United States - Percentage of visitors from the United States.

Visits of Unknown Origin - Percentage of visitors from an origin that could not be determined.

Visitors Who Visited More Than Once - Number of individual visitors who appear more than once in the log file. Individuals can be tracked by IP addresses, domain names, and cookies. Cookies provide the most accurate count.

Visitors Who Visited Once - Number of individual visitors who appear only once in the log file. Individuals can be tracked by IP addresses, domain names, and cookies. Cookies provide the most accurate count.

The General Statistics page provides an overview of your Web site's performance and visitor behavior and can help you determine which chapters will be most valuable to you.

This report was generated by WebTrends.

TO BE PUBLISHED IN DAILY INDEPENDENT 24 OCT 06

PAID AD

Paid Public Announcement

PUBLIC NOTICE

UNITED STATES AIR FORCE

Notice of Availability

Draft Environmental Assessment for Routine and Recurring Unmanned Aerial Vehicle (UAV) Flight Operations at Edwards Air Force Base, California

The United States Air Force is seeking public comment on an environmental assessment for a proposed plan to conduct test and evaluation of unmanned aerial vehicles (UAVs) at the Air Force Flight Test Center (AFFTC) located at Edwards Air Force Base (AFB), California, primarily within restricted airspace R-2515. (Restricted airspace R-2515 stretches from approximately the southwest corner of the base to northeast of Johannesburg, Calif. east to near Fort Irwin north of Barstow.) Additionally, some limited flights are proposed to occur throughout the R-2508 complex and through transitional corridors to other ranges at the Naval Air Weapons Center and Point Mugu Sea Range within California, and the Nellis Test and Training Range in Nevada. (The R-2508 complex overlies the area encompassed by Edwards Air Force Base west to just east of Arvin, Calif., north to the northeast of Fresno, east past Bishop to Death Valley, southeast to Shoshone, Calif., southwest past Barstow to Edwards AFB.)

To fulfill the goals of the Office of the Secretary of Defense, the AFFTC needs to conduct test and evaluation of developmental UAVs to demonstrate critical technologies in a realistic, yet controlled environment. The purpose of the Proposed Action is to continue the routine and recurring mission of the AFFTC as the center of flight and flight systems test and evaluation for the Air Force that parallel manned missions by evolving the capability to test UAVs and their associated aeronautical systems in the same manner as manned aircraft. Aircraft weapon system testing is a primary mission of the AFFTC.

This environmental assessment evaluates the potential environmental effects of four alternatives in supporting the test and evaluation of UAVs.

- **Alternative A**, the Proposed Action, would authorize the AFFTC to conduct up to 152 flight tests (including chase aircraft) in 2006 — increasing to up to 528 flight tests in 2011 — for all classes of UAVs within the R-2508 Complex
- **Alternative B** would limit the tests to Edwards AFB and the R-2515 restricted use airspace.
- **Alternative C** would limit the tests to the airspace above Edwards AFB.
- **Alternative D**, the No-Action Alternative, would allow for the continued operation of current programs like the Global Hawk and Predator UAVs.

Please Note: This notice was submitted to originally run in the *Daily Independent* on August 31, 2006 but did not. An additional public review period has been added.

The document is part of the Environmental Impact Analysis Process which identifies potential environmental impacts on the physical, natural, and human environment associated with the implementation of this proposal. The resulting analysis and documentation are intended to comply with the provisions of the 1969 National Environmental Policy Act and implementing regulations.

Copies of the environmental assessment are available for public review on the Edwards AFB web site (www.edwards.af.mil/penvmng/Documents/reviewdocs.htm) and the following libraries: Edwards AFB Base Library; Air Force Flight Test Center Technical Library; Kern County Libraries (Boron, California City, Mojave, Ridgecrest, Rosamond [Wanda Kirk]); Inyo County Library (Bishop); and Los Angeles County Library (Lancaster).

The deadline for public comments is November 27, 2006.

Mail comments to:
95th Air Base Wing Civil Engineer Directorate
Environmental Management Division
Attn: Gary Hatch
5 E. Popson Ave.
Edwards AFB CA 93524-8060

Comments may also be faxed to (661) 277-6415 or e-mailed to 95abw.pae@edwards.af.mil. If you have questions, you may call Hatch at (661) 277-1454.

95th Air Base Wing Civil Engineer Directorate • Environmental Management Division
5 East Popson Avenue, Building 2650A • Edwards AFB, CA 93524-8060

Specifications:
3 cols by 8.75 inches.

PART 1501--NEPA AND AGENCY PLANNING

Authority: NEPA, the Environmental Quality Improvement Act of 1970, as amended (42 U.S.C. 4371 et seq.), sec. 309 of the Clean Air Act, as amended (42 U.S.C. 7609, and E.O. 11514 (Mar. 5, 1970, as amended by E.O. 11991, May 24, 1977).

Source: 43 FR 55992, Nov. 29, 1978, unless otherwise noted.

Sec. 1501.1 Purpose.

The purposes of this part include:

(a) Integrating the NEPA process into early planning to insure appropriate consideration of NEPA's policies and to eliminate delay.

(b) Emphasizing cooperative consultation among agencies before the environmental impact statement is prepared rather than submission of adversary comments on a completed document.

(c) Providing for the swift and fair resolution of lead agency disputes.

(d) Identifying at an early stage the significant environmental issues deserving of study and deemphasizing insignificant issues, narrowing the scope of the environmental impact statement accordingly.

(e) Providing a mechanism for putting appropriate time limits on the environmental impact statement process.

Sec. 1501.2 Apply NEPA early in the process.

Agencies shall integrate the NEPA process with other planning at the earliest possible time to insure that planning and decisions reflect environmental values, to avoid delays later in the process, and to head off potential conflicts. Each agency shall:

(a) Comply with the mandate of section 102(2)(A) to "utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decisionmaking which may have an impact on man's environment," as specified by Sec. 1507.2.

(b) Identify environmental effects and values in adequate detail so they can be compared to economic and technical analyses. Environmental documents and appropriate analyses shall be circulated and reviewed at the same time as other planning documents.

(c) Study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources as provided by section 102(2)(E) of the Act.

(d) Provide for cases where actions are planned by private applicants or other non-Federal entities before Federal involvement so that:

1. Policies or designated staff are available to advise potential applicants of studies or other information foreseeably required for later Federal action.
2. The Federal agency consults early with appropriate State and local agencies and Indian tribes and with interested private persons and organizations when its own involvement is reasonably foreseeable.
3. The Federal agency commences its NEPA process at the earliest possible time.

Sec. 1501.3 When to prepare an environmental assessment.

(a) Agencies shall prepare an environmental assessment (Sec. 1508.9) when necessary under the procedures adopted by individual agencies to supplement these regulations as described in Sec. 1507.3. An assessment is not necessary if the agency has decided to prepare an environmental impact statement.

(b) Agencies may prepare an environmental assessment on any action at any time in order to assist agency planning and decisionmaking.

Sec. 1501.4 Whether to prepare an environmental impact statement.

In determining whether to prepare an environmental impact statement the Federal agency shall:

(a) Determine under its procedures supplementing these regulations (described in Sec. 1507.3) whether the proposal is one which:

1. Normally requires an environmental impact statement, or
2. Normally does not require either an environmental impact statement or an environmental assessment (categorical exclusion).

(b) If the proposed action is not covered by paragraph (a) of this section, prepare an environmental assessment (Sec. 1508.9). The agency shall involve environmental agencies, applicants, and the public, to the extent practicable, in preparing assessments required by Sec. 1508.9(a)(1).

(c) Based on the environmental assessment make its determination whether to prepare an environmental impact statement.

(d) Commence the scoping process (Sec. 1501.7), if the agency will prepare an environmental impact statement.

(e) Prepare a finding of no significant impact (Sec. 1508.13), if the agency determines on the basis of the environmental assessment not to prepare a statement.

1. The agency shall make the finding of no significant impact available to the affected public as specified in Sec. 1506.6.

2. certain limited circumstances, which the agency may cover in its procedures under Sec. 1507.3, the agency shall make the finding of no significant impact available for public review (including State and areawide clearinghouses) for 30 days before the agency makes its final determination whether to prepare an environmental impact statement and before the action may begin. The circumstances are:

    (i) The proposed action is, or is closely similar to, one which normally requires the preparation of an environmental impact statement under the procedures adopted by the agency pursuant to Sec. 1507.3, or

    (ii) The nature of the proposed action is one without precedent.

Sec. 1501.5 Lead agencies.

(a) A lead agency shall supervise the preparation of an environmental impact statement if more than one Federal agency either:

1. Proposes or is involved in the same action; or

2. Is involved in a group of actions directly related to each other because of their functional interdependence or geographical proximity.

(b) Federal, State, or local agencies, including at least one Federal agency, may act as joint lead agencies to prepare an environmental impact statement (Sec. 1506.2).

(c) If an action falls within the provisions of paragraph (a) of this section the potential lead agencies shall determine by letter or memorandum which agency shall be the lead agency and which shall be cooperating agencies. The agencies shall resolve the lead agency question so as not to cause delay. If there is disagreement among the agencies, the following factors (which are listed in order of descending importance) shall determine lead agency designation:

1. Magnitude of agency's involvement.
2. Project approval/disapproval authority.
3. Expertise concerning the action's environmental effects.
4. Duration of agency's involvement.
5. Sequence of agency's involvement.

(d) Any Federal agency, or any State or local agency or private person substantially affected by the absence of lead agency designation, may make a written request to the potential lead agencies that a lead agency be designated.

(e) If Federal agencies are unable to agree on which agency will be the lead agency or if the procedure described in paragraph (c) of this

section has not resulted within 45 days in a lead agency designation, any of the agencies or persons concerned may file a request with the Council asking it to determine which Federal agency shall be the lead agency. A copy of the request shall be transmitted to each potential lead agency. The request shall consist of:

1. A precise description of the nature and extent of the proposed action.
2. A detailed statement of why each potential lead agency should or should not be the lead agency under the criteria specified in paragraph (c) of this section.

(f) A response may be filed by any potential lead agency concerned within 20 days after a request is filed with the Council. The Council shall determine as soon as possible but not later than 20 days after receiving the request and all responses to it which Federal agency shall be the lead agency and which other Federal agencies shall be cooperating agencies.

[43 FR 55992, Nov. 29, 1978; 44 FR 873, Jan. 3, 1979]

Sec. 1501.6 Cooperating agencies.

The purpose of this section is to emphasize agency cooperation early in the NEPA process. Upon request of the lead agency, any other Federal agency which has jurisdiction by law shall be a cooperating agency. In addition any other Federal agency which has special expertise with respect to any environmental issue, which should be addressed in the statement may be a cooperating agency upon request of the lead agency. An agency may request the lead agency to designate it a cooperating agency.

(a) The lead agency shall:

1. Request the participation of each cooperating agency in the NEPA process at the earliest possible time.
2. Use the environmental analysis and proposals of cooperating agencies with jurisdiction by law or special expertise, to the maximum extent possible consistent with its responsibility as lead agency.
3. Meet with a cooperating agency at the latter's request.

(b) Each cooperating agency shall:

1. Participate in the NEPA process at the earliest possible time.
2. Participate in the scoping process (described below in Sec. 1501.7).
3. Assume on request of the lead agency responsibility for developing information and preparing environmental analyses including portions of the environmental impact statement concerning which the cooperating agency has special expertise.
4. Make available staff support at the lead agency's request to enhance the latter's interdisciplinary capability.
5. Normally use its own funds. The lead agency shall, to the extent available funds permit, fund those major activities or analyses it requests from cooperating agencies. Potential lead agencies shall include such funding requirements in their budget requests.

(c) A cooperating agency may in response to a lead agency's request for assistance in preparing the environmental impact statement

(described in paragraph (b)(3), (4), or (5) of this section) reply that other program commitments preclude any involvement or the degree of involvement requested in the action that is the subject of the environmental impact statement. A copy of this reply shall be submitted to the Council.

Sec. 1501.7 Scoping. There shall be an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action. This process shall be termed scoping. As soon as practicable after its decision to prepare an environmental impact statement and before the scoping process the lead agency shall publish a notice of intent (Sec. 1508.22) in the Federal Register except as provided in Sec. 1507.3(e).

(a) As part of the scoping process the lead agency shall:

1. Invite the participation of affected Federal, State, and local agencies, any affected Indian tribe, the proponent of the action, and other interested persons (including those who might not be in accord with the action on environmental grounds), unless there is a limited exception under Sec. 1507.3(c). An agency may give notice in accordance with Sec. 1506.6.
2. Determine the scope (Sec. 1508.25) and the significant issues to be analyzed in depth in the environmental impact statement.
3. Identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3), narrowing the discussion of these issues in the statement to a brief presentation of why they will not have a significant effect on the human environment or providing a reference to their coverage elsewhere.
4. Allocate assignments for preparation of the environmental impact statement among the lead and cooperating agencies, with the lead agency retaining responsibility for the statement.
5. Indicate any public environmental assessments and other environmental impact statements which are being or will be prepared that are related to but are not part of the scope of the impact statement under consideration.
6. Identify other environmental review and consultation requirements so the lead and cooperating agencies may prepare other required analyses and studies concurrently with, and integrated with, the environmental impact statement as provided in Sec. 1502.25.
7. Indicate the relationship between the timing of the preparation of environmental analyses and the agency's tentative planning and decisionmaking schedule.

(b) As part of the scoping process the lead agency may:

1. Set page limits on environmental documents (Sec. 1502.7).
2. Set time limits (Sec. 1501.8).
3. Adopt procedures under Sec. 1507.3 to combine its environmental assessment process with its scoping process.
4. Hold an early scoping meeting or meetings which may be integrated with any other early planning meeting the agency has. Such a scoping meeting will often be appropriate when the impacts of a particular action are confined to specific sites.

(c) An agency shall revise the determinations made under paragraphs (a) and (b) of this section if substantial changes are

made later in the proposed action, or if significant new circumstances or information arise which bear on the proposal or its impacts.

Sec. 1501.8 Time limits.

Although the Council has decided that prescribed universal time limits for the entire NEPA process are too inflexible, Federal agencies are encouraged to set time limits appropriate to individual actions (consistent with the time intervals required by Sec. 1506.10). When multiple agencies are involved the reference to agency below means lead agency.

(a) The agency shall set time limits if an applicant for the proposed action requests them: Provided, That the limits are consistent with the purposes of NEPA and other essential considerations of national policy.

(b) The agency may:

1. Consider the following factors in determining time limits:

    (i) Potential for environmental harm.
    (ii) Size of the proposed action.
    (iii) State of the art of analytic techniques.
    (iv) Degree of public need for the proposed action, including the consequences of delay.
    (v) Number of persons and agencies affected.
    (vi) Degree to which relevant information is known and if not known the time required for obtaining it.
    (vii) Degree to which the action is controversial.
    (viii) Other time limits imposed on the agency by law, regulations, or executive order.

2. Set overall time limits or limits for each constituent part of the NEPA process, which may include:

    (i) Decision on whether to prepare an environmental impact statement (if not already decided).
    (ii) Determination of the scope of the environmental impact statement.
    (iii) Preparation of the draft environmental impact statement.
    (iv) Review of any comments on the draft environmental impact statement from the public and agencies.
    (v) Preparation of the final environmental impact statement.
    (vi) Review of any comments on the final environmental impact statement.
    (vii) Decision on the action based in part on the environmental impact statement.

3. Designate a person (such as the project manager or a person in the agency's office with NEPA responsibilities) to expedite the NEPA process.

(c) State or local agencies or members of the public may request a Federal Agency to set time limits.

Back to Table of Contents

PART 1506--OTHER REQUIREMENTS OF NEPA

Sec.

Authority: NEPA, the Environmental Quality Improvement Act of 1970, as amended (42 U.S.C. 4371 et seq.), sec. 309 of the Clean Air Act, as amended (42 U.S.C. 7609), and E.O. 11514 (Mar. 5, 1970, as amended by E.O. 11991, May 24, 1977).

Source: 43 FR 56000, Nov. 29, 1978, unless otherwise noted.

Sec. 1506.1 Limitations on actions during NEPA process.

(a) Until an agency issues a record of decision as provided in Sec. 1505.2 (except as provided in paragraph (c) of this section), no action concerning the proposal shall be taken which would:

1. Have an adverse environmental impact; or
2. Limit the choice of reasonable alternatives.

(b) If any agency is considering an application from a non-Federal entity, and is aware that the applicant is about to take an action within the agency's jurisdiction that would meet either of the criteria in paragraph (a) of this section, then the agency shall promptly notify the applicant that the agency will take appropriate action to insure that the objectives and procedures of NEPA are achieved.

(c) While work on a required program environmental impact statement is in progress and the action is not covered by an existing program statement, agencies shall not undertake in the interim any major Federal action covered by the program which may significantly affect the quality of the human environment unless such action:

1. Is justified independently of the program;
2. Is itself accompanied by an adequate environmental impact statement;
and
3. Will not prejudice the ultimate decision on the program. Interim action prejudices the ultimate decision on the program when it tends to determine subsequent development or limit alternatives.

(d) This section does not preclude development by applicants of plans or designs or performance of other work necessary to support an application for Federal, State or local permits or assistance. Nothing in this section shall preclude Rural Electrification Administration approval of minimal expenditures not affecting the environment (e.g. long leadtime equipment and purchase options) made by non-governmental entities seeking loan

guarantees from the Administration.

Sec. 1506.2 Elimination of duplication with State and local procedures.

(a) Agencies authorized by law to cooperate with State agencies of statewide jurisdiction pursuant to section 102(2)(D) of the Act may do so.

(b) Agencies shall cooperate with State and local agencies to the fullest extent possible to reduce duplication between NEPA and State and local requirements, unless the agencies are specifically barred from doing so by some other law. Except for cases covered by paragraph (a) of this section, such cooperation shall to the fullest extent possible include:

1. Joint planning processes.
2. Joint environmental research and studies.
3. Joint public hearings (except where otherwise provided by statute).
4. Joint environmental assessments.

(c) Agencies shall cooperate with State and local agencies to the fullest extent possible to reduce duplication between NEPA and comparable State and local requirements, unless the agencies are specifically barred from doing so by some other law. Except for cases covered by paragraph (a) of this section, such cooperation shall to the fullest extent possible include joint environmental impact statements. In such cases one or more Federal agencies and one or more State or local agencies shall be joint lead agencies. Where State laws or local ordinances have environmental impact statement requirements in addition to but not in conflict with those in NEPA, Federal agencies shall cooperate in fulfilling these requirements as well as those of Federal laws so that one document will comply with all applicable laws.

(d) To better integrate environmental impact statements into State or local planning processes, statements shall discuss any inconsistency of a proposed action with any approved State or local plan and laws (whether or not federally sanctioned). Where an inconsistency exists, the statement should describe the extent to which the agency would reconcile its proposed action with the plan or law.

Sec. 1506.3 Adoption.

(a) An agency may adopt a Federal draft or final environmental impact statement or portion thereof provided that the statement or portion thereof meets the standards for an adequate statement under these regulations.

(b) If the actions covered by the original environmental impact statement and the proposed action are substantially the same, the agency adopting another agency's statement is not required to recirculate it except as a final statement. Otherwise the adopting agency shall treat the statement as a draft and recirculate it (except as provided in paragraph (c) of this section).

(c) A cooperating agency may adopt without recirculating the environmental impact statement of a lead agency when, after an independent review of the statement, the cooperating agency concludes that its comments and suggestions have been satisfied.

(d) When an agency adopts a statement which is not final within the agency that prepared it, or when the action it assesses is the subject of a referral under Part 1504, or when the statement's adequacy is the subject of a judicial action which is not final, the agency shall so specify.

Sec. 1506.4 Combining documents.

Any environmental document in compliance with NEPA may be combined with any other agency document to reduce duplication and paperwork.

Sec. 1506.5 Agency responsibility.

(a) Information. If an agency requires an applicant to submit environmental information for possible use by the agency in preparing an environmental impact statement, then the agency should assist the applicant by outlining the types of information required. The agency shall independently evaluate the information submitted and shall be responsible for its accuracy. If the agency chooses to use the information submitted by the applicant in the environmental impact statement, either directly or by reference, then the names of the persons responsible for the independent evaluation shall be included in the list of preparers (Sec. 1502.17). It is the intent of this paragraph that acceptable work not be redone, but that it be verified by the agency.

(b) Environmental assessments. If an agency permits an applicant to prepare an environmental assessment, the agency, besides fulfilling the requirements of paragraph (a) of this section, shall make its own evaluation of the environmental issues and take responsibility for the scope and content of the environmental assessment.

(c) Environmental impact statements. Except as provided in Secs. 1506.2 and 1506.3 any environmental impact statement prepared pursuant to the requirements of NEPA shall be prepared directly by or by a contractor selected by the lead agency or where appropriate under Sec. 1501.6(b), a cooperating agency. It is the intent of these regulations that the contractor be chosen solely by the lead agency, or by the lead agency in cooperation with cooperating agencies, or where appropriate by a cooperating agency to avoid any conflict of interest. Contractors shall execute a disclosure statement prepared by the lead agency, or where appropriate the cooperating agency, specifying that they have no financial or other interest in the outcome of the project. If the document is prepared by contract, the responsible Federal official shall furnish guidance and participate in the preparation and shall independently evaluate the statement prior to its approval and take responsibility for its scope and contents. Nothing in this section is intended to prohibit any agency from requesting any person to submit information to it or to prohibit any person from submitting information to any agency.

Sec. 1506.6 Public involvement.

Agencies shall:

(a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.

(b) Provide public notice of NEPA-related hearings, public meetings,

and the availability of environmental documents so as to inform those persons and agencies who may be interested or affected.

1. In all cases the agency shall mail notice to those who have requested it on an individual action.
2. In the case of an action with effects of national concern notice shall include publication in the Federal Register and notice by mail to national organizations reasonably expected to be interested in the matter and may include listing in the 102 Monitor. An agency engaged in rulemaking may provide notice by mail to national organizations who have requested that notice regularly be provided. Agencies shall maintain a list of such organizations.
3. In the case of an action with effects primarily of local concern the notice may include:

    (i) Notice to State and areawide clearinghouses pursuant to OMB Circular A- 95 (Revised).

    (ii) Notice to Indian tribes when effects may occur on reservations.

    (iii) Following the affected State's public notice procedures for comparable actions.

    (iv) Publication in local newspapers (in papers of general circulation rather than legal papers).

    (v) Notice through other local media.

    (vi) Notice to potentially interested community organizations including small business associations.

    (vii) Publication in newsletters that may be expected to reach potentially interested persons.

    (viii) Direct mailing to owners and occupants of nearby or affected property.

    (ix) Posting of notice on and off site in the area where the action is to be located.

(c) Hold or sponsor public hearings or public meetings whenever appropriate or in accordance with statutory requirements applicable to the agency. Criteria shall include whether there is:

1. Substantial environmental controversy concerning the proposed action or substantial interest in holding the hearing.

2. A request for a hearing by another agency with jurisdiction over the action supported by reasons why a hearing will be helpful. If a draft environmental impact statement is to be considered at a public hearing, the agency should make the statement available to the public at least 15 days in advance (unless the purpose of the hearing is to provide information for the draft environmental impact statement).

(d) Solicit appropriate information from the public.

(e) Explain in its procedures where interested persons can get

information or status reports on environmental impact statements and other elements of the NEPA process.

(f) Make environmental impact statements, the comments received, and any underlying documents available to the public pursuant to the provisions of the Freedom of Information Act (5 U.S.C. 552), without regard to the exclusion for interagency memoranda where such memoranda transmit comments of Federal agencies on the environmental impact of the proposed action. Materials to be made available to the public shall be provided to the public without charge to the extent practicable, or at a fee which is not more than the actual costs of reproducing copies required to be sent to other Federal agencies, including the Council.

Sec. 1506.7 Further guidance.

The Council may provide further guidance concerning NEPA and its procedures including:

(a) A handbook which the Council may supplement from time to time, which shall in plain language provide guidance and instructions concerning the application of NEPA and these regulations.

(b) Publication of the Council's Memoranda to Heads of Agencies.

(c) In conjunction with the Environmental Protection Agency and the publication of the 102 Monitor, notice of:

1. Research activities;
2. Meetings and conferences related to NEPA; and
3. Successful and innovative procedures used by agencies to implement NEPA.

Sec. 1506.8 Proposals for legislation.

(a) The NEPA process for proposals for legislation (Sec. 1508.17) significantly affecting the quality of the human environment shall be integrated with the legislative process of the Congress. A legislative environmental impact statement is the detailed statement required by law to be included in a recommendation or report on a legislative proposal to Congress. A legislative environmental impact statement shall be considered part of the formal transmittal of a legislative proposal to Congress; however, it may be transmitted to Congress up to 30 days later in order to allow time for completion of an accurate statement which can serve as the basis for public and Congressional debate. The statement must be available in time for Congressional hearings and deliberations.

(b) Preparation of a legislative environmental impact statement shall conform to the requirements of these regulations except as follows:

1. There need not be a scoping process.
2. The legislative statement shall be prepared in the same manner as a draft statement, but shall be considered the "detailed statement" required by statute; Provided, That when any of the following conditions exist both the draft and final environmental impact statement on the legislative proposal shall be prepared and circulated as provided by Secs. 1503.1 and 1506.10.

(i) A Congressional Committee with jurisdiction over the proposal has a rule requiring both draft and final environmental impact statements.
(ii) The proposal results from a study process required by statute (such as those required by the Wild and Scenic Rivers Act (16 U.S.C. 1271 et seq.) and the Wilderness Act (16 U.S.C. 1131 et seq.)).
(iii) Legislative approval is sought for Federal or federally assisted construction or other projects which the agency recommends be located at specific geographic locations. For proposals requiring an environmental impact statement for the acquisition of space by the General Services Administration, a draft statement shall accompany the Prospectus or the 11(b) Report of Building Project Surveys to the Congress, and a final statement shall be completed before site acquisition.
(iv) The agency decides to prepare draft and final statements.

(c) Comments on the legislative statement shall be given to the lead agency which shall forward them along with its own responses to the Congressional committees with jurisdiction.

Sec. 1506.9 Filing requirements.

Environmental impact statements together with comments and responses shall be filed with the Environmental Protection Agency, attention Office of Federal Activities (A-104), 401 M Street SW., Washington, DC 20460. Statements shall be filed with EPA no earlier than they are also transmitted to commenting agencies and made available to the public. EPA shall deliver one copy of each statement to the Council, which shall satisfy the requirement of availability to the President. EPA may issue guidelines to agencies to implement its responsibilities under this section and Sec. 1506.10.

Sec. 1506.10 Timing of agency action.

(a) The Environmental Protection Agency shall publish a notice in the Federal Register each week of the environmental impact statements filed during the preceding week. The minimum time periods set forth in this section shall be calculated from the date of publication of this notice.

(b) No decision on the proposed action shall be made or recorded under Sec. 1505.2 by a Federal agency until the later of the following dates:

1. Ninety (90) days after publication of the notice described above in paragraph (a) of this section for a draft environmental impact statement.
2. Thirty (30) days after publication of the notice described above in paragraph (a) of this section for a final environmental impact statement. An exception to the rules on timing may be made in the case of an agency decision which is subject to a formal internal appeal. Some agencies have a formally established appeal process which allows other agencies or the public to take appeals on a decision and make their views known, after publication of the final environmental impact statement. In such cases, where a real opportunity exists to alter the

decision, the decision may be made and recorded at the same time the environmental impact statement is published.

This means that the period for appeal of the decision and the 30-day period prescribed in paragraph (b)(2) of this section may run concurrently. In such cases the environmental impact statement shall explain the timing and the public's right of appeal. An agency engaged in rulemaking under the Administrative Procedure Act or other statute for the purpose of protecting the public health or safety, may waive the time period in paragraph (b)(2) of this section and publish a decision on the final rule simultaneously with publication of the notice of the availability of the final environmental impact statement as described in paragraph (a) of this section.

(c) If the final environmental impact statement is filed within ninety (90) days after a draft environmental impact statement is filed with the Environmental Protection Agency, the minimum thirty (30) day period and the minimum ninety (90) day period may run concurrently. However, subject to paragraph (d) of this section agencies shall allow not less than 45 days for comments on draft statements.

(d) The lead agency may extend prescribed periods. The Environmental Protection Agency may upon a showing by the lead agency of compelling reasons of national policy reduce the prescribed periods and may upon a showing by any other Federal agency of compelling reasons of national policy also extend prescribed periods, but only after consultation with the lead agency. (Also see Sec. 1507.3(d).) Failure to file timely comments shall not be a sufficient reason for extending a period. If the lead agency does not concur with the extension of time, EPA may not extend it for more than 30 days. When the Environmental Protection Agency reduces or extends any period of time it shall notify the Council.

[43 FR 56000, Nov. 29, 1978; 44 FR 874, Jan. 3, 1979]

Sec. 1506.11 Emergencies.

Where emergency circumstances make it necessary to take an action with significant environmental impact without observing the provisions of these regulations, the Federal agency taking the action should consult with the Council about alternative arrangements. Agencies and the Council will limit such arrangements to actions necessary to control the immediate impacts of the emergency. Other actions remain subject to NEPA review.

Sec. 1506.12 Effective date.

The effective date of these regulations is July 30, 1979, except that for agencies that administer programs that qualify under section 102(2)(D) of the Act or under section 104(h) of the Housing and Community Development Act of 1974 an additional four months shall be allowed for the State or local agencies to adopt their implementing procedures.

(a) These regulations shall apply to the fullest extent practicable to ongoing activities and environmental documents begun before the effective date. These regulations do not apply to an environmental impact statement or supplement if the draft statement was filed before the effective date of these regulations. No completed environmental documents need be redone by reasons of these regulations. Until these regulations are applicable, the Council's guidelines published in the Federal Register of August 1, 1973, shall

continue to be applicable. In cases where these regulations are applicable the guidelines are superseded. However, nothing shall prevent an agency from proceeding under these regulations at an earlier time.

(b) NEPA shall continue to be applicable to actions begun before January 1, 1970, to the fullest extent possible.

Back to Table of Contents

"NO ACTION ALTERNATIVE" INFORMATION PAPER

NEPA the "Law" and the CEQ Regulations require but do not define the "no action" alternative. There are, however, two distinct interpretations of "no action". In the "Forty Most Asked Questions", CEQ says that the no action alterative "provides a benchmark, enabling decisionmakers to compare the magnitude of environmental effects of the action alternatives." CEQ notes that for newly proposed actions, "no action" means "the proposed activity would not take place, and the resulting environmental effects from taking no action would be compared with the effects of permitting the proposed activity or an alterative activity to go forward." CEQ also note that for continuing actions ("ongoing programs, management plans, etc), no action means "continuing with the present course of action until that action is changed." The "no action" alternative is sometimes referred to as the "Status Quo" alterative. While CEQ emphases the importance of the "no action" alternative the courts have not addressed these definitions and have allowed very brief discussions of this alternative.

1. NEPA THE LAW - no references

2. 40 CFR 1500 REGULATIONS -

§ 1502.14 Alternatives including the proposed action.

> (b) Devote substantial treatment to each **alternative** considered in detail including the proposed action so that reviewers may evaluate their comparative merits
>
> (d) Include the alternative of no action.

§ 1508.25 Scope.

(b) Alternatives, which include: (1) No action alternative.

3. CEQ 40 QUESTIONS -

3. No-Action Alternative. What does the "no action" alternative include? If an agency is under a court order or legislative command to act, must the EIS address the "no action" alternative?

> A. Section 1502.14(d) requires the alternatives analysis in the EIS to "include the alternative of no action." **There are two distinct interpretations of "no action"** that must be considered, depending on the nature of the proposal being evaluated. The first situation might involve an action such as updating a land **management plan** where ongoing programs initiated under existing legislation and regulations will continue, even as new plans are developed. **In these cases "no action" is "no change" from current management direction or level of management intensity. To construct an alternative that is based on no management at all would be a useless academic exercise.** Therefore, the "no action" alternative may be thought of in terms of continuing with the present course of action until that action is changed. Consequently, projected impacts of alternative management schemes would be compared in the EIS to those impacts projected for the existing plan. In this case, alternatives would include management plans of both greater and lesser intensity, especially greater and lesser levels of resource development.

The Court upheld the Adequacy of the EA noting "Whether [a] B/C ratio is above or below parity is not dispositive of an agency's compliance with NEPA, but it does aid the court in determining whether all factors have been taken into account, after which the court may determine whether the agency's decision to approve was arbitrary or capricious.... Consequently, NEPA creates a duty ... to appraise both the economic and environmental costs and benefits of major federal projects.

"The spectrum of possible alternatives must range from a 'no action' proposal to a project configuration that fully accomplishes the original goals without any of the objectional environmental consequences. Each alternative must be given sufficient review to allow the decision-maker a fair opportunity to choose from among options."

6. Prepared by D. Reinke, 703-641-1100

STATE OF CALIFORNIA
Governor's Office of Planning and Research
State Clearinghouse and Planning Unit

Arnold Schwarzenegger
Governor

Sean Walsh
Director

October 2, 2006

Gary Hatch
U.S. Air Force
5 E. Popson Avenue
Building 2650A
Edwards AFB, CA 93524-8060

Subject: Routine and Recurring Unmanned Aerial Vehicle Flight Operations at Edwards Air Force Base
SCH#: 2006084002

Dear Gary Hatch:

The State Clearinghouse submitted the above named Environmental Assessment to selected state agencies for review. The review period closed on September 29, 2006, and no state agencies submitted comments by that date. This letter acknowledges that you have complied with the State Clearinghouse review requirements for draft environmental documents, pursuant to the California Environmental Quality Act.

Please call the State Clearinghouse at (916) 445-0613 if you have any questions regarding the environmental review process. If you have a question about the above-named project, please refer to the ten-digit State Clearinghouse number when contacting this office.

Sincerely,

Terry Roberts

Terry Roberts
Director, State Clearinghouse

1400 TENTH STREET P.O. BOX 3044 SACRAMENTO, CALIFORNIA 95812-3044
TEL (916) 445-0613 FAX (916) 323-3018 www.opr.ca.gov

Document Details Report
State Clearinghouse Data Base

SCH# **2006084002**
Project Title Routine and Recurring Unmanned Aerial Vehicle Flight Operations at Edwards Air Force Base
Lead Agency U.S. Air Force

Type **EA** Environmental Assessment

Description The proposed action is to continue to conduct routine and recurring UAV flight operations in a manner similar to manned aircraft. UAVs would operate primarily in R-2508 and R-2515 special use airspace and conduct flight operation in accordance with AFFTC and NASA mission requirements. Up to 40% of the flight operations would transition to other local Department of Defense Ranges including the Navy Sea Range and Nellis AFB Test and Training Range.

Lead Agency Contact

Name Gary Hatch
Agency U.S. Air Force
Phone (661) 277-1454 ***Fax***
email
Address 5 E. Popson Avenue
Building 2650A
City Edwards AFB ***State*** CA ***Zip*** 93524-8060

Project Location

County Kern; Inyo, San Bernardino
City Lancaster
Region
Cross Streets
Parcel No.
Township ***Range*** ***Section*** ***Base***

Proximity to:

Highways 58
Airports Edwards
Railways
Waterways
Schools
Land Use

Project Issues Air Quality; Cumulative Effects; Landuse; Noise; Other Issues; Public Services; Soil Erosion/Compaction/Grading; Solid Waste; Toxic/Hazardous; Vegetation; Water Supply; Wildlife

Reviewing Agencies Resources Agency; Department of Parks and Recreation; Native American Heritage Commission; Office of Historic Preservation; Department of Fish and Game, Region 6 (Inyo & Mono Region); Department of Fish and Game, Region 6; Department of Water Resources; California Highway Patrol; Caltrans, District 9; Caltrans, District 8; Caltrans, Division of Aeronautics; State Water Resources Control Board, Division of Water Quality; Department of Toxic Substances Control

Date Received 08/29/2006 ***Start of Review*** 08/29/2006 ***End of Review*** 09/29/2006

Note: Blanks in data fields result from insufficient information provided by lead agency.